Second Annual Report
to the
Texas Water Development Board
December, 1974

A Benthos and Plankton Study of the Corpus Christi, Copano and Aransas Bay Systems

II. Report on Data Collected During the Period July, 1973-April, 1974

by

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INTRODUCTION

This second annual report to the Texas Water Development Board includes data collected from July, 1973 to April, 1974 by the University of Texas Marine Science Institute at Port Aransas, Texas. It includes hydrographic, zooplanktonic, phytoplanktonic and benthic data collected at thirty sites in the Corpus Christi Bay complex (Figures 1 and 2). These sites are described in our first annual report (Holland, et al., 1973a).

The basic aim for this year's research was to maintain the sampling program and to simultaneously begin the analysis of data from the first nineteen months of collections (October, 1972 - April, 1974). A great deal of effort has gone into the computer techniques needed to implement the various methods for data analysis. Several different data analysis techniques have been explored; these will be reviewed in the appropriate section.

In this report, we wish to present data collected during the second ten months of the study period, discuss various analytical techniques and present preliminary discussions of observations made during the first two years of this study. Information found in the first annual report will not be repeated except for the species lists and bibliographies, which have been updated.

Data collected during the period covered by this report, has, as was the first year's data, been stored in the TWDB'S Coastal Data System (CDC), a computer operative storage and retrieval system. The system operates on a Univac 1106 computer system which is located at the TWDB in Austin, Texas.

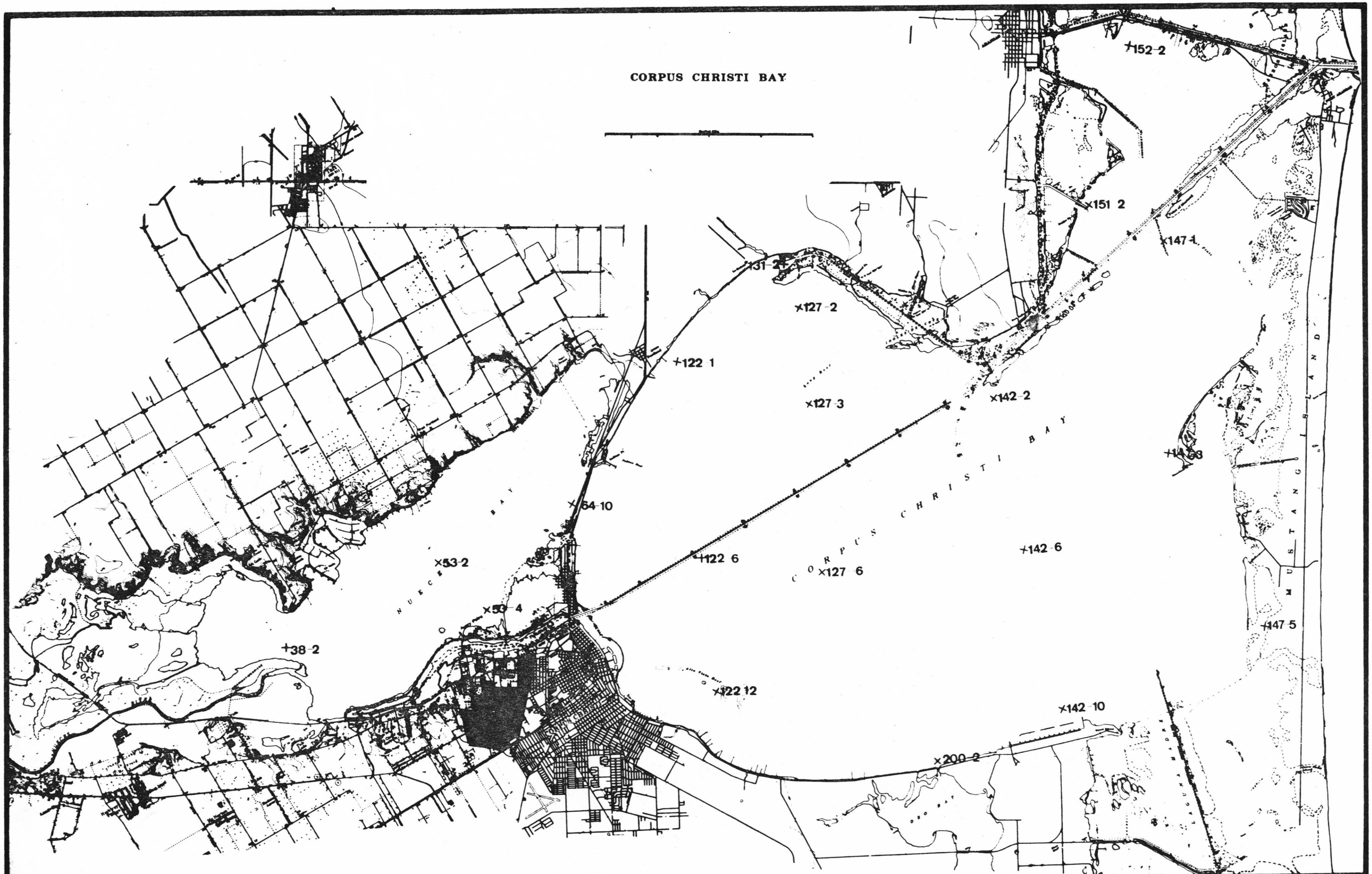

Figure 1. Corpus Christi Bay sampling stations.

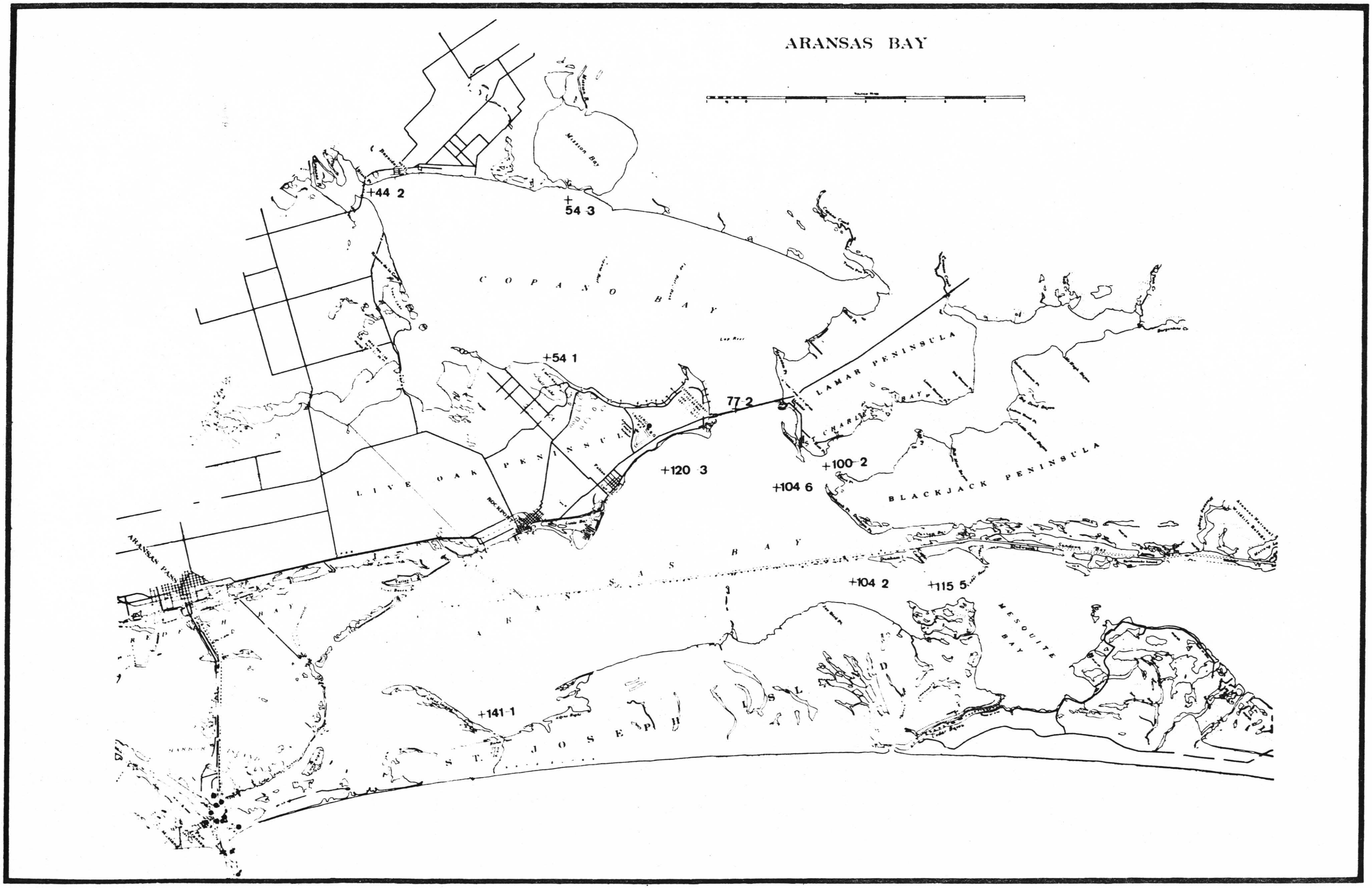

Figure 2. Copano-Aransas Bay sampling stations.

HYDROGRAPHY

Introduction.

Hydrographic parameters measured in this study include total water depth, water temperature, conductivity, dissolved oxygen, nutrients, turbidity and pH. The latter two were added in October, 1973. Nutrients include organic nitrogen, nitrate, nitrite, ammonia, total phosphate, orthophosphate, inorganic carbon and organic carbon. Temperature, dissolved oxygen and conductivity were measured at one foot below the surface, mid-water and one foot above the bottom. Turbidity and pH were measured at the surface. Water samples for nutrient analyses were taken from mid-water depths. Methodology remained the same as in the previous study period. Turbidity was measured with a Hach colorimeter and pH with a Sargent-Welch Model PBL pH meter.

Results.

Hydrographic and nutrient data are presented in Tables 1 and 2 and Figures 3, 4 and 5. The present study period was from July, 1973 to April, 1974. The data presented in the initial report was collected from October, 1972 to June, 1973. The months of October to April are then common to both sets of data and will form the basis for comparisons between the two study periods.

Discussion.

Dissolved oxygen values followed essentially the same pattern during this study period as was initially observed. The monthly mean dissolved oxygen values (Table 1, Figure 3) seem to be slightly lower this period

TABLE 1. MINIMA, MAXIMA AND AVERAGES OF HYDROGRAPHIC PARAMETERS

	WATER TEMP. (°C)			SALINITY (°/oo)			DISSOLVED O_2 (MG/L)			TURBIDITY (JTU)			pH		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
NUECES BAY (LINES 38-64)															
JULY 1973	29.0	30.5	29.8	0.6	13.6	8.4	8.1	9.5	8.7	--	--	--	--	--	--
AUGUST 1973	28.7	29.9	29.4	0.8	23.8	11.0	5.6	7.9	7.1	--	--	--	--	--	--
SEPTEMBER 1973	27.0	29.3	28.2	1.1	18.8	12.6	6.4	7.9	7.3	--	--	--	--	--	--
OCTOBER 1973	21.0	24.2	21.8	0.1	18.3	4.1	4.8	9.4	7.6	50.0	110.0	75.0	7.9	8.3	8.1
NOVEMBER 1973	22.0	23.5	22.7	0.4	10.2	5.0	7.6	10.5	9.9	20.0	89.0	41.2	8.5	8.8	8.6
DECEMBER 1973	14.5	16.5	15.3	1.3	12.6	9.6	7.5	11.0	10.3	20.0	65.0	37.5	8.4	8.4	8.4
JANUARY 1974	9.9	10.9	10.4	16.3	23.3	20.4	7.4	10.6	8.9	55.0	140.0	103.3	8.3	8.4	8.4
FEBRUARY 1974	11.5	13.0	12.4	23.4	28.4	26.6	8.9	10.1	9.4	102.0	260.0	178.2	8.3	8.4	8.4
MARCH 1974	24.5	27.2	26.2	19.2	24.2	22.5	6.6	8.3	7.3	125.0	185.0	156.0	8.0	8.5	8.2
APRIL 1974	22.5	23.5	23.0	17.4	25.5	22.2	7.1	9.2	8.2	70.0	170.0	123.8	8.0	8.2	8.1
CORPUS CHRISTI BAY (LINES 122-200)															
JULY 1973	27.2	30.5	29.1	12.1	34.8	24.0	1.4	8.6	6.3	--	--	--	--	--	--
AUGUST 1973	27.0	30.0	29.0	21.1	32.4	26.3	0.0	8.2	5.9	--	--	--	--	--	--
SEPTEMBER 1973	27.0	28.2	27.6	0.0	25.4	22.0	2.7	6.8	5.9	--	--	--	--	--	--
OCTOBER 1973	22.0	27.5	23.9	3.6	22.0	15.2	3.1	7.6	6.2	3.0	200.0	28.3	8.3	8.4	8.3
NOVEMBER 1973	22.0	25.9	23.5	4.7	22.7	14.1	2.0	11.2	8.2	2.0	40.0	9.3	8.5	8.9	8.6
DECEMBER 1973	14.5	21.0	16.5	15.8	40.6	19.4	0.1	12.6	9.0	8.0	40.0	15.1	8.2	8.7	8.4
JANUARY 1974	9.8	12.6	10.7	22.8	32.0	25.6	0.4	14.1	9.9	1.0	22.0	6.8	8.2	8.5	8.3
FEBRUARY 1974	14.8	19.0	16.8	18.8	30.0	24.5	4.7	9.4	8.2	0.0	30.0	7.7	8.3	8.6	8.4
MARCH 1974	20.2	24.2	22.9	21.5	28.1	25.0	6.1	9.2	7.2	0.0	20.0	9.4	8.2	8.5	8.4
APRIL 1974	20.8	25.0	22.6	24.9	27.0	26.0	5.4	8.6	7.5	0.0	85.0	18.9	8.0	8.5	8.2
REDFISH BAY (LINES 151-152)															
JULY 1973	29.9	30.5	30.1	23.3	27.3	25.1	5.9	8.6	7.3	--	--	--	--	--	--
AUGUST 1973	29.8	30.0	29.9	26.3	28.9	27.8	6.9	8.2	7.4	--	--	--	--	--	--
SEPTEMBER 1973	27.5	27.8	27.6	18.7	23.5	21.1	6.7	6.9	6.8	--	--	--	--	--	--
OCTOBER 1973	22.5	23.0	22.7	9.3	16.7	12.8	3.7	6.5	5.3	15.0	20.0	17.5	8.4	8.4	8.4
NOVEMBER 1973	24.1	25.9	25.1	17.2	20.4	18.5	7.4	9.5	8.4	10.0	10.0	10.0	8.7	8.8	8.8
DECEMBER 1973	17.2	17.8	17.5	15.8	19.5	17.6	9.9	10.6	10.2	20.0	20.0	20.0	8.4	8.4	8.4
JANUARY 1974	10.9	11.1	10.9	22.8	27.1	25.1	9.6	11.4	10.7	2.0	9.0	5.5	8.3	8.3	8.3
FEBRUARY 1974	18.2	19.0	18.9	18.8	25.8	24.0	7.8	8.3	8.0	5.0	14.0	9.5	8.5	8.6	8.5
MARCH 1974	20.9	22.5	21.7	21.5	24.2	22.9	7.6	9.2	8.4	4.0	8.0	6.0	8.4	8.4	8.4
APRIL 1974	24.3	25.0	24.8	25.3	26.2	25.6	6.7	6.9	6.9	5.0	5.0	5.0	8.2	8.2	8.2
COPANO BAY (LINES 44-77)															
JULY 1973	28.5	29.5	29.2	0.6	5.4	2.7	5.4	7.8	6.8	--	--	--	--	--	--
AUGUST 1973	28.5	29.5	28.9	3.3	13.9	6.4	4.5	7.4	6.6	--	--	--	--	--	--
SEPTEMBER 1973	26.3	28.3	27.1	0.0	7.3	4.0	3.7	7.2	6.1	--	--	--	--	--	--
OCTOBER 1973	20.3	21.5	20.9	0.0	3.3	1.2	6.5	8.0	7.3	15.0	75.0	31.5	8.0	8.2	8.1
NOVEMBER 1973	21.5	22.5	21.9	0.4	3.0	1.7	8.3	9.3	8.9	30.0	40.0	37.5	8.5	8.6	8.6
DECEMBER 1973	14.9	15.2	15.0	0.9	4.9	3.2	9.7	10.8	10.2	30.0	75.0	45.0	8.3	8.5	8.4
JANUARY 1974	10.1	16.1	13.4	3.4	18.1	6.9	10.4	12.3	11.2	0.0	42.0	13.0	8.3	8.4	8.3
FEBRUARY 1974	17.0	18.5	17.7	4.8	8.8	6.9	8.6	10.3	9.2	5.0	54.0	19.4	8.4	8.6	8.5
MARCH 1974	25.0	25.8	25.3	6.9	12.2	8.8	6.7	8.4	7.4	15.0	21.0	18.2	8.2	8.6	8.4
APRIL 1974	20.1	21.0	20.5	9.0	23.2	14.2	8.3	9.0	8.5	30.0	75.0	55.0	8.4	8.6	8.5
ARANSAS BAY (LINES 100-141)															
JULY 1973	28.5	29.5	29.1	4.8	12.4	7.4	6.8	8.5	7.3	--	--	--	--	--	--
AUGUST 1973	27.2	29.7	28.3	11.2	20.1	14.5	5.5	7.0	6.3	--	--	--	--	--	--
SEPTEMBER 1973	27.8	28.0	27.9	5.4	12.0	7.8	6.8	7.7	7.2	--	--	--	--	--	--
OCTOBER 1973	21.0	22.9	21.7	1.0	6.5	3.0	8.0	9.6	8.8	18.0	68.0	37.2	8.2	8.4	8.3
NOVEMBER 1973	22.0	23.5	22.8	1.6	23.4	6.6	5.7	10.3	9.2	20.0	90.0	44.2	8.4	8.8	8.7
DECEMBER 1973	14.9	16.8	16.0	2.0	15.2	7.3	10.1	10.9	10.4	5.0	85.0	45.0	8.4	8.6	8.5
JANUARY 1974	12.6	18.1	15.6	6.8	23.9	12.8	11.0	13.4	12.7	1.0	22.0	13.3	8.5	8.9	8.6
FEBRUARY 1974	16.0	19.2	17.9	7.5	23.8	11.9	8.7	10.8	9.2	9.0	39.0	20.3	8.4	8.7	8.5
MARCH 1974	23.0	26.1	24.4	12.1	19.6	15.6	6.4	8.0	7.3	10.0	72.0	26.0	8.2	8.7	8.4
APRIL 1974	18.0	20.0	19.0	13.3	19.4	15.3	8.7	9.5	9.0	0.0	32.0	18.7	8.3	8.5	8.4

-- no sample taken

TABLE 2. MINIMA, MAXIMA AND AVERAGES OF NUTRIENT PARAMETERS.

	NO_2 MG/L			NO_3 MG/L			NH_4 MG/L			ORGANIC N_2 MG/L			ORTHO PO_4 MG/L			TOTAL PO_4 MG/L			ORGANIC C MG/L			INORGANIC C MG/L		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
NUECES BAY (LINES 38-64)																								
JULY 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.70	0.80	0.73	0.06	0.11	0.09	0.12	0.17	0.15	34.0	52.0	45.5	18.0	19.0	18.3
AUGUST 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.50	0.80	0.62	0.03	0.13	0.08	0.08	0.22	0.13	27.0	34.0	29.5	10.0	17.0	14.0
SEPTEMBER 1973	0.005	0.010	0.006	0.03	0.12	0.05	0.10	0.10	0.10	0.50	0.70	0.60	0.01	0.22	0.07	0.05	0.34	0.13	—	—	—	—	—	—
OCTOBER 1973	0.005	0.008	0.006	0.03	0.11	0.08	0.10	0.20	0.12	0.40	0.70	0.52	0.09	0.20	0.16	0.09	0.28	0.19	18.0	56.0	32.5	11.0	19.0	15.0
NOVEMBER 1973	0.005	0.005	0.005	0.03	0.04	0.04	0.10	0.10	0.10	0.50	1.10	0.75	0.07	0.18	0.12	0.14	0.26	0.18	22.0	20.0	28.0	7.0	12.0	9.2
DECEMBER 1973	0.005	0.005	0.005	0.03	0.14	0.06	0.10	0.10	0.10	0.30	0.50	0.42	0.06	0.13	0.08	0.07	0.18	0.11	30.0	35.0	32.7	10.0	19.0	15.0
JANUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.60	1.10	0.78	0.02	0.03	0.02	0.11	0.13	0.12	26.0	40.0	32.2	12.0	20.0	16.8
FEBRUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.60	1.30	0.92	0.03	0.06	0.04	0.12	0.29	0.19	7.0	42.0	26.8	19.0	29.0	22.0
MARCH 1974	0.023	0.035	0.029	0.03	0.06	0.04	0.10	0.20	0.15	0.50	0.70	0.60	0.03	0.06	0.04	0.08	0.19	0.13	16.0	30.0	25.0	26.0	31.0	28.0
APRIL 1974	0.005	0.580	0.028	0.03	0.09	0.05	0.10	0.10	0.10	0.50	1.10	0.85	0.10	0.04	0.03	0.07	0.14	0.09	22.0	55.0	34.5	9.0	19.0	13.0
CORPUS CHRISTI BAY (LINES 122-200)																								
JULY 1973	0.005	0.008	0.005	0.03	0.04	0.03	0.01	0.10	0.10	0.20	0.90	0.60	0.01	0.05	0.02	0.02	0.14	0.06	40.0	63.0	45.0	10.0	18.0	16.0
AUGUST 1973	0.005	0.005	0.005	0.03	0.04	0.31	0.10	0.10	0.10	0.20	0.60	0.38	0.01	0.03	0.02	0.02	0.08	0.04	21.0	47.0	27.3	10.0	15.0	13.2
SEPTEMBER 1973	0.005	0.026	0.006	0.03	0.10	0.03	0.10	0.10	0.10	0.20	1.00	0.43	0.01	0.34	0.04	0.02	0.48	0.06	—	—	—	—	—	—
OCTOBER 1973	0.005	0.014	0.006	0.03	0.03	0.03	0.10	0.20	0.11	0.20	1.20	0.53	0.02	0.11	0.05	0.03	0.30	0.07	20.0	52.0	29.3	8.0	19.0	13.0
NOVEMBER 1973	0.005	0.027	0.006	0.03	0.03	0.03	0.10	1.00	0.16	0.30	1.00	0.62	0.01	0.33	0.06	0.03	0.40	0.09	13.0	34.0	21.7	5.0	18.0	13.3
DECEMBER 1973	0.005	0.008	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	1.00	0.36	0.01	0.28	0.05	0.03	0.43	0.08	23.0	46.0	30.5	8.0	20.0	15.2
JANUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.04	1.00	0.15	0.10	0.70	0.43	0.02	0.10	0.03	0.03	0.20	0.05	22.0	32.0	26.3	8.0	18.0	15.2
FEBRUARY 1974	0.005	0.014	0.006	0.03	0.03	0.03	0.10	0.40	0.12	0.30	0.80	0.44	0.01	0.37	0.04	0.02	0.40	0.06	22.0	51.0	32.9	12.0	17.0	14.4
MARCH 1974	0.005	0.005	0.005	0.03	0.05	0.03	0.10	0.10	0.10	0.30	0.40	0.34	0.01	0.03	0.02	0.01	0.03	0.03	9.0	28.0	19.3	13.0	28.0	18.1
APRIL 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	1.30	0.46	0.01	0.23	0.03	0.02	0.44	0.06	15.0	36.0	25.6	9.0	23.0	12.0
REDFISH BAY (LINES 151-152)																								
JULY 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.50	0.70	0.60	0.01	0.01	0.01	0.02	0.03	0.02	48.0	48.0	48.0	14.0	14.0	14.0
AUGUST 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	0.20	0.20	0.01	0.01	0.01	0.02	0.04	0.03	21.0	26.0	23.5	13.0	14.0	13.5
SEPTEMBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	0.50	0.35	0.01	0.01	0.01	0.02	0.02	0.02	—	—	—	—	—	—
OCTOBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.60	0.70	0.65	0.02	0.04	0.03	0.03	0.06	0.04	22.0	27.0	24.5	16.0	19.0	17.5
NOVEMBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	1.00	0.65	0.01	0.02	0.02	0.03	0.04	0.04	20.0	21.0	20.5	13.0	15.0	14.0
DECEMBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	0.20	0.20	0.01	0.02	0.02	0.04	0.04	0.04	28.0	44.0	36.0	12.0	20.0	16.0
JANUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	0.60	0.45	0.02	0.02	0.02	0.03	0.03	0.03	24.0	30.0	27.0	15.0	16.0	15.5
FEBRUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	0.40	0.35	0.01	0.02	0.02	0.03	0.03	0.03	29.0	41.0	35.0	14.0	16.0	15.0
MARCH 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	0.30	0.30	0.01	0.01	0.01	0.01	0.02	0.02	19.0	20.0	19.5	13.0	14.0	13.5
APRIL 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.40	0.40	0.40	0.01	0.02	0.02	0.03	0.04	0.04	23.0	23.0	23.0	10.0	12.0	11.0

Table 2. cont.'d

COPANO BAY (LINES 44-77)

	NO_2 MG/L			NO_3 MG/L			NH_4 MG/L			ORGANIC N_2 MG/L			ORTHO PO_4 MG/L			TOTAL PO_4 MG/L			ORGANIC C MG/L			INORGANIC C MG/L		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
JULY 1973	0.005	0.014	0.007	0.03	0.03	0.03	0.10	0.10	0.10	0.70	0.90	0.78	0.04	0.06	0.05	0.09	0.11	0.10	41.0	49.0	45.8	7.0	17.0	12.5
AUGUST 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.50	1.00	0.80	0.04	0.06	0.05	0.08	0.15	0.10	33.0	57.0	45.2	8.0	17.0	11.2
SEPTEMBER 1973	0.005	0.050	0.018	0.03	0.18	0.06	0.10	0.10	0.10	0.50	1.40	0.83	0.04	0.30	0.11	0.06	0.43	0.17	--	--	--	--	--	--
OCTOBER 1973	0.005	0.007	0.005	0.06	0.13	0.09	0.10	0.10	0.10	0.40	0.50	0.43	0.03	0.16	0.08	0.06	0.20	0.11	21.0	31.0	26.2	4.0	10.0	7.5
NOVEMBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.20	0.70	0.50	0.06	0.08	0.07	0.10	0.12	0.11	27.0	27.0	27.0	10.0	10.0	10.0
DECEMBER 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	0.40	0.38	0.05	0.07	0.06	0.08	0.12	0.10	22.0	34.0	30.0	7.0	19.0	13.0
JANUARY 1974	0.005	0.008	0.006	0.03	0.03	0.03	0.10	0.10	0.10	0.40	0.70	0.50	0.06	0.07	0.06	0.07	0.10	0.09	31.0	36.0	34.0	15.0	20.0	17.0
FEBRUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.50	0.70	0.57	0.02	0.07	0.04	0.05	0.07	0.06	27.0	36.0	31.7	15.0	20.0	18.0
MARCH 1974	0.005	0.005	0.005	0.03	0.05	0.04	0.10	0.10	0.10	0.40	0.50	0.45	0.05	0.05	0.05	0.06	0.09	0.07	32.0	62.0	47.8	21.0	32.0	28.2
APRIL 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.40	0.50	0.43	0.04	0.05	0.04	0.06	0.08	0.07	27.0	46.0	36.2	13.0	15.0	13.5

ARANSAS BAY (LINES 100-141)

	NO_2 MG/L			NO_3 MG/L			NH_4 MG/L			ORGANIC N_2 MG/L			ORTHO PO_4 MG/L			TOTAL PO_4 MG/L			ORGANIC C MG/L			INORGANIC C MG/L		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
JULY 1973	0.005	0.008	0.006	0.03	0.03	0.03	0.10	0.10	0.10	0.50	0.90	0.65	0.03	0.06	0.05	0.06	0.10	0.08	39.0	51.0	42.5	13.0	16.0	14.0
AUGUST 1973	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.40	0.70	0.45	0.02	0.07	0.05	0.03	0.11	0.07	25.0	68.0	36.5	6.0	16.0	12.7
SEPTEMBER 1973	0.005	0.008	0.006	0.03	0.06	0.04	0.10	0.10	0.10	0.50	1.10	0.65	0.04	0.07	0.05	0.05	0.10	0.08	--	--	--	--	--	--
OCTOBER 1973	0.005	0.014	0.008	0.12	0.33	0.25	0.10	0.10	0.10	0.40	0.70	0.53	0.07	0.20	0.13	0.08	0.24	0.14	19.0	37.0	29.0	13.0	25.0	17.8
NOVEMBER 1973	0.005	0.005	0.005	0.03	0.09	0.05	0.10	0.10	0.10	0.30	0.70	0.50	0.04	0.12	0.09	0.05	0.16	0.12	19.0	33.0	26.3	10.0	19.0	16.2
DECEMBER 1973	0.005	0.011	0.006	0.03	0.04	0.03	0.10	0.10	0.10	0.20	0.50	0.27	0.04	0.07	0.06	0.07	0.10	0.08	17.0	52.0	34.3	10.0	25.0	17.0
JANUARY 1974	0.005	0.006	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.30	0.80	0.52	0.02	0.07	0.04	0.05	0.14	0.09	21.0	53.0	31.8	16.0	25.0	20.8
FEBRUARY 1974	0.005	0.005	0.005	0.03	0.03	0.03	0.10	0.10	0.10	0.40	0.60	0.48	0.03	0.03	0.03	0.04	0.09	0.06	29.0	42.0	33.5	15.0	19.0	17.2
MARCH 1974	0.005	0.005	0.005	0.03	0.04	0.03	0.10	0.10	0.10	0.30	0.50	0.37	0.03	0.06	0.04	0.05	0.09	0.06	18.0	54.0	32.3	15.0	32.0	26.5
APRIL 1974	0.005	0.050	0.020	0.03	0.05	0.03	0.10	0.10	0.10	0.00	0.60	0.32	0.03	0.04	0.04	0.05	0.07	0.06	25.0	152.0	82.3	11.0	20.0	15.5

-- no sample taken

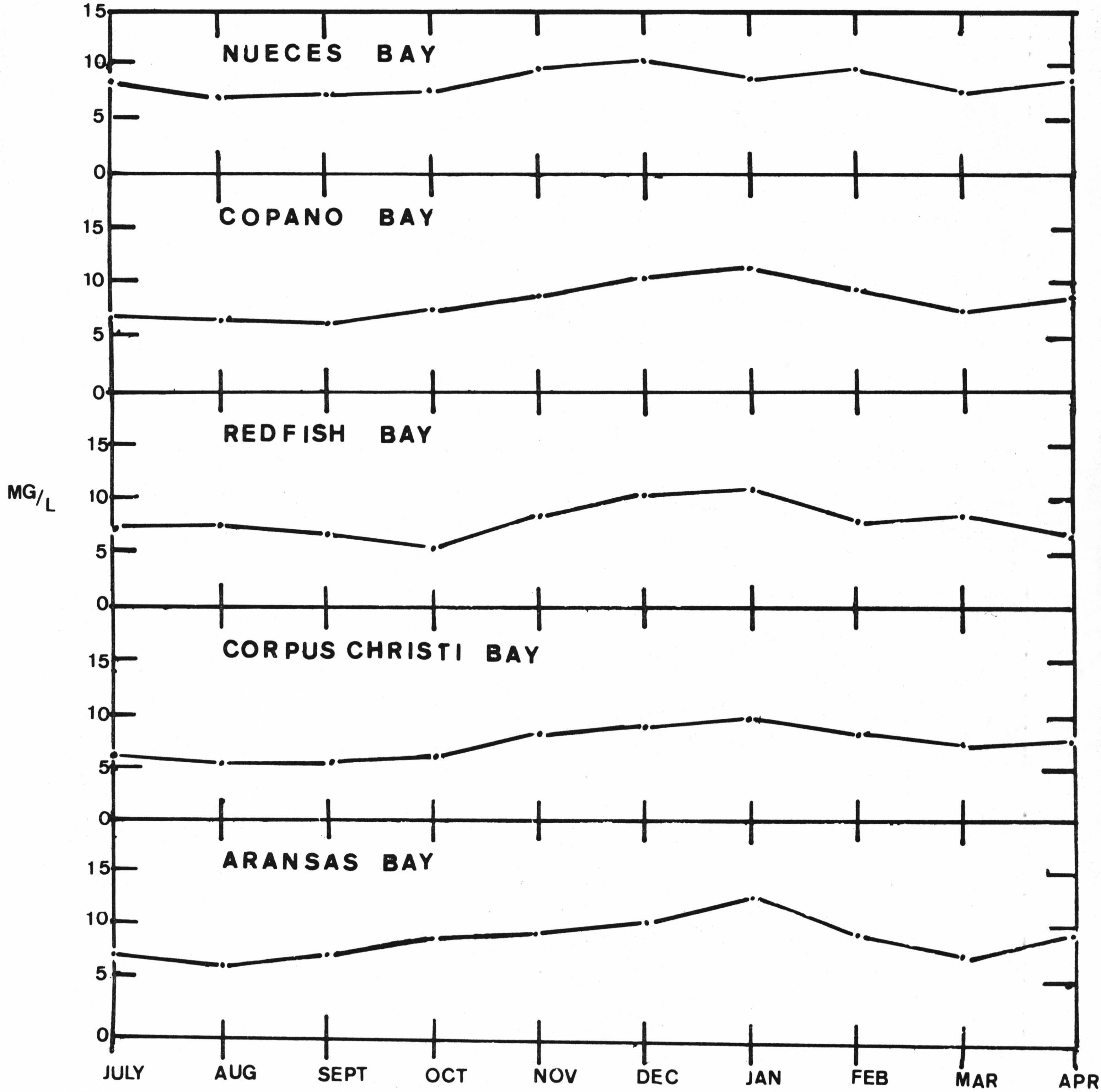

Figure 3. Monthly mean dissolved oxygen values.

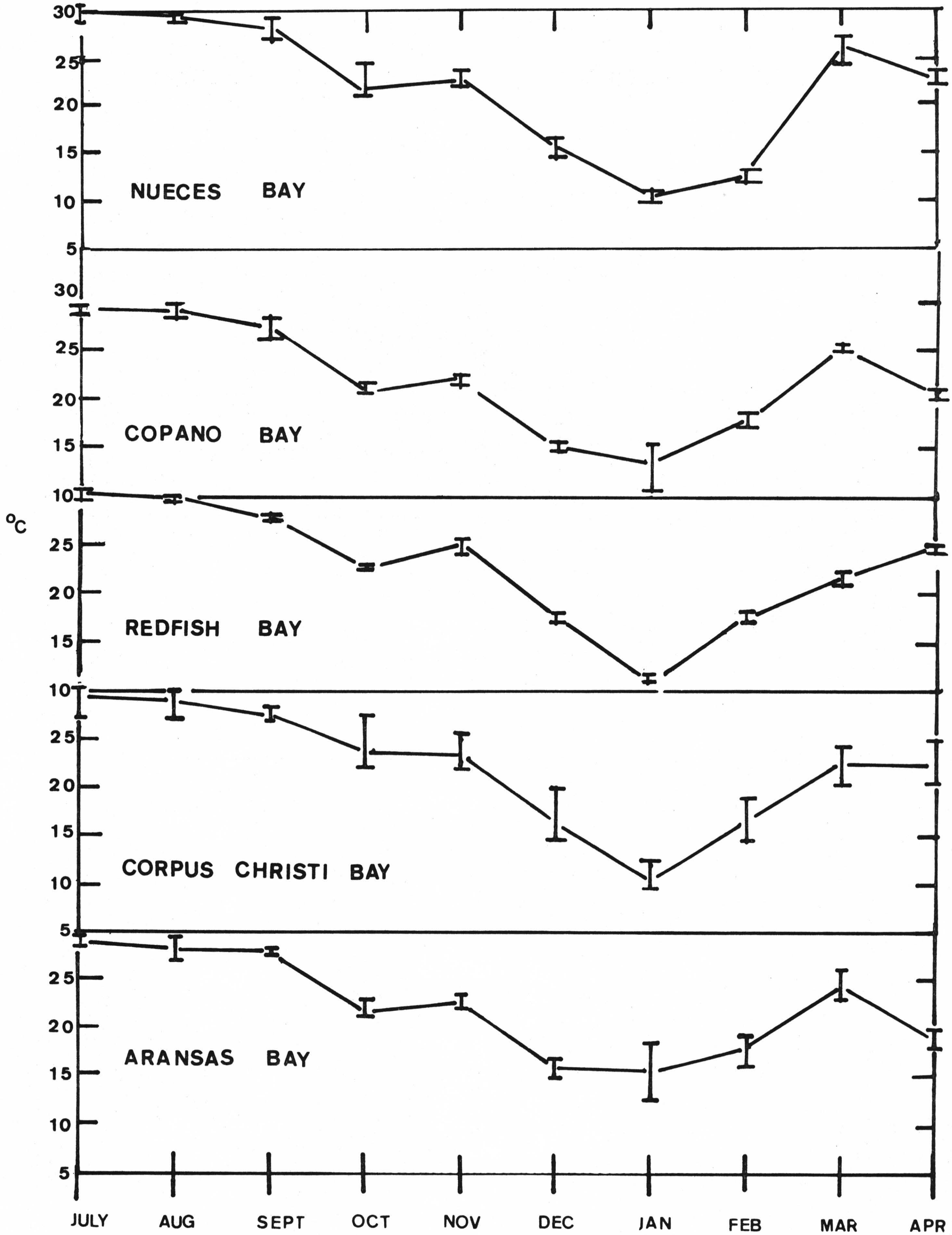

Figure 4. Monthly mean temperature values, showing minima and maxima.

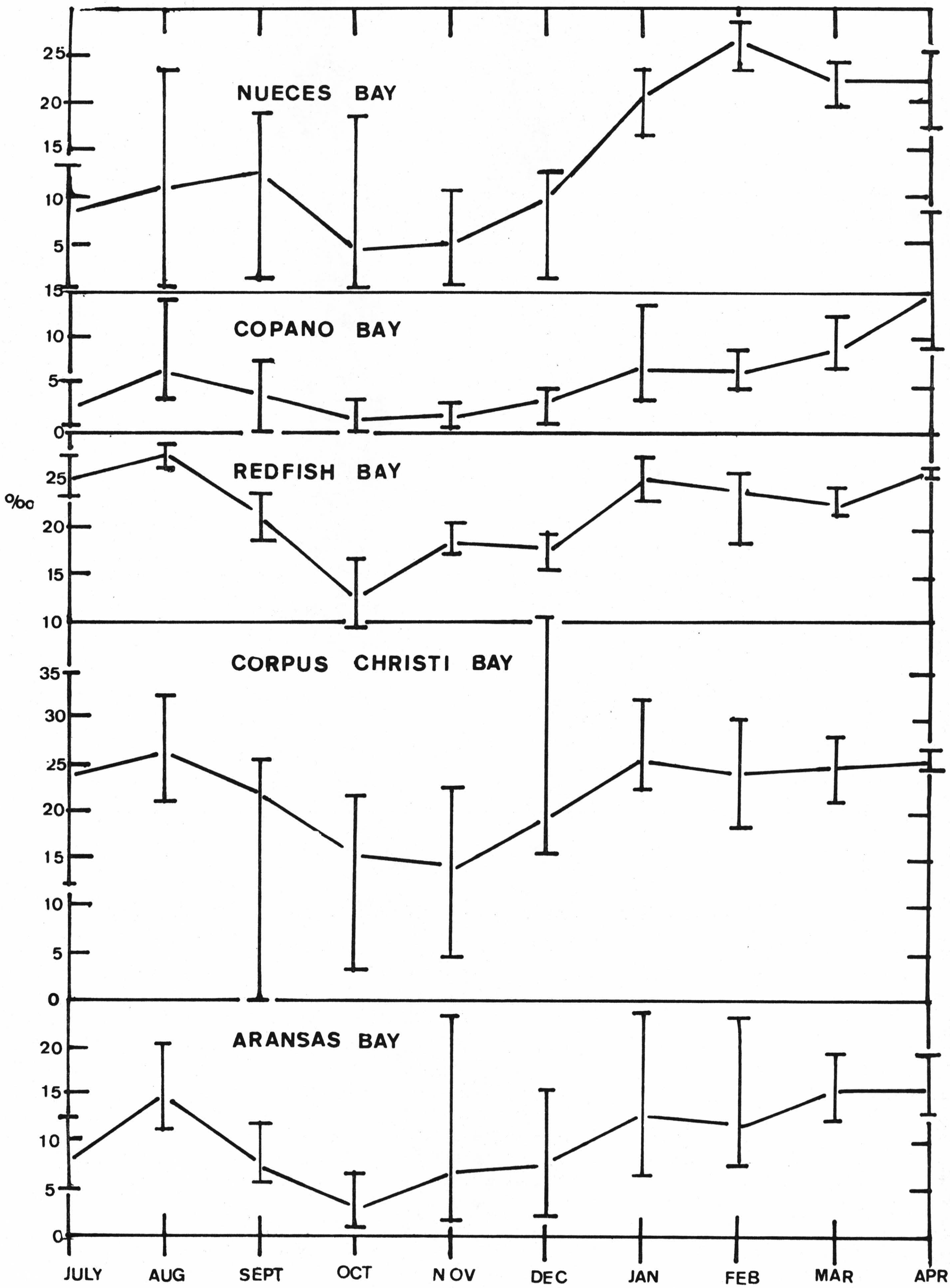

Figure 5. Monthly mean salinities, showing minima and maxima.

in Copano and Aransas Bays but the peak values still occurred in December - January which coincides, as would be expected, with the lowest water temperatures (minimum temperatures in all five bays occurred in January). Minimum dissolved oxygen values were observed from August through October which are not as well correlated to maximum temperatures (which occurred in July-August for all bays). Several other factors, eg. salinity, winds, affect the dissolved oxygen content of estuarine water. Mean salinities were generally lowest in October. Considering the inverse relationship between dissolved oxygen and salinity, the fact that the O_2 values were lowest when salinities were also lowest would indicate that some factor other than salinity is most important in determining dissolved oxygen content of the water. Salinities have generally peaked during the spring months of March, April and May for all bays in the study area. Dissolved oxygen values have shown a slight tendency to increase during these months despite increasing salinity and rising water temperatures. We would hypothesize that winds, which are much more prevalent during the spring months and least prevalent generally in July and August, are the major abiotic factor, other than water temperature, in determining the dissolved oxygen content of these bays. Possible biological effects will be discussed in the proper sections.

Mean monthly water temperatures (Table 1, Figure 4) again follow patterns similar to those previously reported. January means for all bays except Aransas Bay are slightly higher than recorded in the first report. It is interesting to note that during both study periods, water temperatures generally increased from January to March in all bays and decreased in April. This decrease is not evident this period for Redfish Bay and was least evident for this bay in the initial report. The water temperature depression in April of both years may be due to a real air temperature depression for these months or may be an artifact due to sampling time. Strong northerly winds during these spring months often prevent sampling due to small boat limitations. Immediately after a norther has blown through our area, a relatively calm period follows and may be utilized before water temperatures would be warmed to "normal" for the month. Maximum temperatures were recorded in July and August which were not covered in the previous study period. Mean temperatures equaled or approached 30^{o}C. in all bays during July and August. All stations sampled during this study are offshore in relatively deep waters. Higher temperatures might be expected near shore in shallow waters.

Monthly mean salinities (Table 1, Figure 5) were somewhat lower during the second study period. October - December, 1973 had decidedly lower salinities than the same months in 1972. January - April, 1974 salinities were also generally lower except in Redfish Bay. Copano Bay is apparently the bay of lowest salinity in the study area. Nueces Bay is unique in its widely fluctuating mean salinity, which ranged from less than 5 ppt. to more than 25 ppt. during this study period. Its mean was high, ca. 25 ppt., and relatively stable during the first study period. Salinities in Aransas Bay are lower than those in Corpus Christi and Redfish Bays. Salinities for both years are thought to be low in the long term salinity cycle of the area due to the above average rainfall during the two study periods. While tangential effects were felt, no hurricanes actually struck within the study area during this or the previous report period.

Turbidity and pH measurements (Table 1) were started in October, 1973; thus no comparisons can be made. Mean monthly turbidity appears to be highest in Nueces Bay with Copano and Aransas Bays following closely. Redfish Bay consistently has the lowest turbidities measured. Temporally, no patterns of turbidity distribution are evident, possibly due to the short time this parameter has been examined. pH ranged from 7.9 to 8.9 over the seven months this parameter was measured. As yet, no spatial or temporal distributions are evident.

Hydrographically, the two estuarine systems in our study area appear somewhat dissimilar. The Mission-Aransas estuary (Copano and Aransas Bays) appears to be a classic example of a lower salinity, positive estuary. Symaps from the first study period and all subsequent data point to a generally low salinity at the river mouths, gradually increasing to highest salinities near the Gulf of Mexico. It is generally slightly more turbid than the Nueces estuary. The Nueces estuary (Nueces and Corpus Christi Bays) does not always exhibit the classic positive salinity gradient. Salinities are often higher in upper reaches of the estuary than in the lower. Often no gradient pattern can be observed. It apparently has a much freer exchange of water with the Gulf of Mexico and unusual water circulation patterns.

The minima, maxima and averages for all nutrients collected during this period are given in Table 2. Nutrient data for three months, December, January and March, are included in both study periods and are therefore the basis of comparison. Apparently all nutrient concentrations were very similar during both study periods. The initial report concluded that a drop of phosphates and nitrates was evident in March. There is some evidence of a slight decline in these nutrients during the spring months of the present report period.

Maximum levels of phosphates and nitrates were generally found at or near inflow areas. This is the same pattern as was previously noted. Nutrient information will be discussed further in the phytoplankton section.

Symaps were not generated for this year's report, but will be resumed as they contribute greatly in the interpretation of nutrient data.

ZOOPLANKTON

Introduction.

The zooplankton data in this report covers the period from July, 1973 through March, 1974. This data along with the data in the first annual report (Holland et al., 1973a) gives an account of the species collected, standing crop values, seasonal distribution of selected zooplankters, and species diversity ($\bar{d}$) values for zooplankton in Corpus Christi and adjacent bay systems over an eighteen month period.

Methods.

The field collecting and laboratory methods remained the same as previously reported. Starting with the November, 1973 zooplankton, laboratory analysis was discontinued at stations 53-4, 122-6, 127-3, 142-2, 142-10 and 147-3 in order to expedite counting. In December, 1973 station 131-2 was discontinued. These stations are still being collected and will be analyzed at a later date.

Mean catch data presented in this report is based on the number of stations analyzed in each bay system (Table 3).

Results and Discussion.

A list of zooplankters collected from October, 1972 - March, 1974 is found in Table 4.

Standing crops of individuals per cubic meter and means have been tabulated for July, 1973 - February, 1974 and are found in Table 5. In July, 1973 there was a drop in mean standing crop values in all bay systems which can be correlated with lower salinities (Tables 5 and 1) due to

Acartia tonsa Lee, L&O 18(2), p. 232 16% total wt = lipid, 17% of that is triglyceride

p. 234
13% is mean value for subtropical copepods at 0-500 m

decapods, mysids + euphasids range from 7 to 24% lip
fish (near shore) 15% or less

also Deep Sea Research 18: 1147-65 for more lists of critters

Table 3. Number of stations analyzed for zooplankton each month by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72	4	16	4	6
Nov. '72	4	16	4	6
Dec. '72	4	16	4	6
Jan. '73	4	16	4	6
Feb. '73	4	16	4	6
Mar. '73	4	16	4	6
Apr. '73	4	16	4	6
May '73	4	16	4	6
June '73	4	16	4	6
July '73	4	16	4	6
Aug. '73	4	16	4	6
Sept.'73	4	16	4	6
Oct. '73	4	16	4	6
Nov. '73	3	11	4	6
Dec. '73	3	10	4	6
Jan. '74	3	10	4	6
Feb. '74	3	10	4	6
Mar. '74	3	10	4	6

Table 4. Zooplankton from Corpus Christi and adjacent bay systems

PHYLUM PROTOZOA
- Class Ciliophora
  - Order Spirotricha
    - Family Tintinnidae
      - Tintinnid A
      - Tintinnid B
      - Tintinnid C
- Class Mastigophora
  - Order Dinoflagellata
    - *Noctiluca scintillans*

PHYLUM COELENTERATA
- Class Hydrozoa
  - Order Hydroida
    - *Hydra* sp.
    - Medusae A
    - Medusae B
- Class Scyphozoa
  - *Stomalophus meleagris*
- Class Anthozoa
  - Anemone

PHYLUM CTENOPHORA
- Class Tentaculata
  - *Mnemiopsis mccradyi*
- Class Nuda
  - *Beroe ovata*

PHYLUM PLATYHELMINTHES
- Class Turbellaria
  - Order Acoela
    - Flatworm A
    - Flatworm B

PHYLUM NEMERTINEA
- Nemertean

PHYLUM ROTIFERA
- *Asplanchna* sp.
- *Brachionus plicatilis*
- *Brachionus quadradentata*
- *Brachionus* sp.
- *Lecane* sp.
- *Tetramastix* sp.
- Rotifer A
- Rotifer B

PHYLUM NEMATODA
- Nematode

PHYLUM ANNELIDA

Class Polychaeta

Scaleworm larvae

Polychaete larvae

Family Syllidae

Autolytus prolifer

Brania clavata

Exogone dispar

Family Nereidae

Nereid (reproductive form)

Family Spionidae

Polydora sp.

Streblospio benedicti

Family Sabellidae

Chone duneri

Family Serpulidae

Pomatoleios kraussi

Sphaeropomatus miamiensis

Class Hirudinea

Leech

PHYLUM MOLLUSCA

Class Gastropoda

Gastropod larvae

Pteropod

Order Nudibranchia

Elysia sp.

Sea Hare

Class Pelecypoda

Pelecypod larvae

Family Lyonsiidae

Lyonsia hyalina

Class Cephalopoda

Lolliguncula brevis

PHYLUM ARTHROPODA

Class Arachnida

Order Acarina

Hydracarina (water mites)

Class Crustacea

Order Notostraca

Triops sp.

Order Diplostraca

Conchostracan

Cladocerans (immature)

Penilia avirostris

Evadne nordmanni

Podon sp.

Family Sididae

Diaphanosoma sp.

Family Daphnidae

Daphnia sp.

Ceriodaphnia sp.
Moina sp.
Simocephalus sp.
Family Bosminidae
Bosmina sp.
Family Macrothricidae
Ilyocryptus spinifer
Macrothrix sp.
Family Chydoridae
Chydorus sp.
Alona sp.
Alonella sp.
Euryalona sp.
Order Myodocopa
Family Halcyprididae
Ostracod (cf. *Concheocia* sp.)
Order Podocopa
Ostracod
Order Calanoida
Family Calanidae % of total wt = lipid
Eucalanus sp. 37, 36, 31
Rhincalanus cornutus 42, 69
Family Paracalanidae
Paracalanus crassirostris
Paracalanus indicus
Paracalanus quasimodo
Family Pseudocalanidae
Clausocalanus furcatus
Family Centropagidae
Centropages furcatus
Centropages hamatus
Family Diaptomidae
Diaptomus sp.
Family Temoridae
Eurytemora sp.
Temora turbinata
Temora stylifera
Family Lucicutiidae
Lucicutia magna
Family Pontellidae
Anomalocera ornata
Calanopia americana
Labidocera aestiva
Labidocera scotti
Pontella sp. copepodid
Pontella pennata
Pontella spinipes
Pontella meadii
Family Acartiidae
Acartia tonsa
Acartia danae

Family Tortanidae
Tortanus setacaudatus
Order Harpacticoida
Family Longipediidae
Longipedia coronata
Family Canuellidae
Canuella sp.
Family Ectinosomidae
Ectinosoma sp.
Family Harpacticidae
Harpacticus sp.
Zausodes arenicolus
Family Peltidiidae
Alteutha depressa
Family Tegastidae
Parategastes sp.
Family Tisbidae
Tisbella sp.
Tisbe sp.
Family Thalestridae
Paradactylopodia brevicornis
Dactylopusia tisboides
Thalestrid A
Thalestrid B
Diarthrodes nobilis
Diarthrodes sp.
Family Diosaccidae
Amphiascus pallidus
Amphiascus sp.
Stenhelia palustris
Schizopera sp.
Robertsonia sp. A
Robertsonia sp. B
Diosaccid A
Diosaccid B
Family Canthocamptidae
Mesochra sp. A
Mesochra sp. B
Bryocamptus sp.
Nitocra sp.
Family Laophontidae
Heterolaophonte cf. *sigmoides*
Laophonte cornuta
Onychocamptus sp. (male)
Onychocamptus chanthamensis
Onychocamptus mohammed
Paralaophonte congenera
Paronychocamptus sp.
Paronychocamptus cf. *capillatus*
Paronychocamptus cf. *curticaudata*
Subfamily Normanellinae

Family Macrosetellidae
- *Macrosetella gracilis*

Family Tachidiidae
- *Clytemnestra scutellata*
- *Euterpinna acutifrons*
- *Microarthidion littorale*
- *Thomsonula curticauda*
- Tachidiid A

Family Metidae
- *Metis* sp.

Family Cletodidae
- *Cletocamptus albuquerquensis*
- *Cletocamptus* sp.
- *Enhydrosoma* sp. A
- *Enhydrosoma* sp. B
- *Nannopus palustris*
- Cletodid A

Family Unidentified
- Harpacticoid A
- Harpacticoid B

Order Cyclopoida

Family Oithonidae
- *Oithona brevicornis*
- *Oithona nana*
- *Oithona plumifera*

Family Cyclopinidae
- *Cyclopina* sp.

Family Cyclopidae
- *Halicyclops* sp.
- *Cyclops* sp.
- *Mesocyclops* sp.
- *Mesocyclops edax*
- *Macrocyclops albidus*
- *Macrocyclops ater*
- *Microcyclops* sp.
- *Eucyclops agilis*
- *Paracyclops* sp.
- *Hemicyclops* sp.
- *Neocyclops* sp.

Family Oncaeidae
- *Oncaea* sp.
- *Oncaea mediterranea*

Family Corycaeidae
- *Corycaeus* sp. (immature)
- *Corycaeus amazonicus*
- *Corycaeus americanus*
- *Corycaeus giesbrechti*

Family Ergasilidae
- *Ergasilis* sp.

Family Unidentified
- Cyclopoid A
- Cyclopoid B
- Cyclopoid C

Cyclopoid D
Cyclopoid Copepodids
Copepod Nauplii (Calanoid, Harpacticoid and Cyclopoid combined)

Order Caligoida
- Family Caligidae
  - *Caligus* sp.
  - *Caligus* sp. metanauplius
- Family Argulidae
  - *Argulus alosae*
  - *Argulus flavescens*
  - *Argulus funduli*

Order Thoracica
- Barnacle nauplii
- Barnacle cypris larvae

Order Stomatopoda
- Stomatopod antizoea
- Stomatopod pseudozoea

Order Mysidacea
- Family Mysidae
  - *Mysidopsis* sp. (immature)
  - *Mysidopsis almyra*
  - *Mysidopsis bigelowi*
  - *Taphromysis louisianae*
  - *Bowmaniella* sp. (immature)

Order Cumacea
- Cumacean (immature)
- *Cyclaspis varians*

Order Tanaidacea
- *Leptochelia rapax*

Order Isopoda
- Family Idoteidae
  - *Edotea triloba*
  - *Erichsonella attenuata*
- Family Cymothoidae
  - *Aegathoa oculata*
- Family Sphaeromatidae
  - *Cassidinidea lunifrons*
  - *Cymodoce faxoni*
  - *Sphaeroma quadradentatum*
- Family Bopyridae
  - Bopyrid A

Order Amphipoda
- Family Amphithoidae
  - *Cymadusa* sp.
- Family Atylidae
  - *Atylus* sp.
- Family Corophiidae
  - *Corophium louisianum*
  - *Corophium ascherusicum*
  - *Cerapus tubularis*
  - *Erichthonius brasiliensis*

Family Gammaridae
Gammarid A
Gammarus mucronatus
Family Liljeborgiidae
Listriella clymenella
Family Hyperiidae
Hyperia sp.
Family Caprellidae
Caprellid (immature)
Luconacia incerta
Order Decapoda
Family Penaeidae
Penaeid protozoea
Penaeus aztecus postlarvae
Penaeus setiferus postlarvae
Lucifer faxoni protozoea
Lucifer faxoni
Family Sergestidae
Acetes sp. larvae
Acetes americanus louisianensis
Family Palaemonidae
Palaemonetes sp. zoea
Palaemonetes pugio
Macrobrachium sp. zoea
Family Alpheidae
Alpheus sp. zoea
Family Ogyrididae
Ogyrides limicola zoea
Family Hippolytidae
Tozeuma carolinense zoea
Family Unidentified
Caridean zoea A
Caridean zoea B
Family Callianassidae
Callianassa sp. zoea A
Callianassa sp. zoea B
Upogebia affinis zoea
Family Porcellanidae
Petrolisthes armatus zoea
Petrolisthes armatus megalops
Porcellanid zoea
Family Paguridae
Pagurid zoea A
Pagurid zoea B
Clibanarias vittatus zoea
Family Hippidae
Emerita sp. zoea
Family Portunidae
Callinectes sp. zoea
Callinectes sp. megalops
Callinectes sapidus

Family Xanthidae
- *Menippe mercenaria* zoea
- *Rhithropanopeus harrissi* zoea
- *Hexapanopeus* sp. megalops
- *Panopeus* sp. cf. zoea

Family Pinnotheridae
- Pinnotherid zoea (general)
- Pinnotherid zoea A
- *Pinnixia* sp. zoea
- *Pinnixia* sp. megalops
- *Pinnixia* sp. (juvenile)
- *Pinnotheres* sp. zoea

Family Ocypodidae
- *Uca* sp. zoea

Family Unidentified
- Brachyuran zoea A
- Brachyuran zoea B
- Brachyuran zoea C
- Juvenile crab
- Decapod larvae

Class Insecta

Order Hemiptera

Family Corixidae
- Water Boatman

Family Nepidae
- Water Scorpion

Order Ephemeroptera
- Mayfly larvae

Order Odonata
- Dragonfly larvae
- Damselfly larvae

Order Plecoptera
- Stonefly larvae

Order Diptera

Family Culicidae
- Mosquito larvae

Family Tendipedidae
- Midgefly larvae

Order Coleoptera

Family Dytiscidae
- Diving Water Beetle larvae
- Diving Water Beetle

Order Unidentified
- Insect larvae A

PHYLUM PHORONIDA
- Actinotroch larvae

PHYLUM BRYOZOA
- Cyphonautes larvae A
- Cyphonautes larvae B

PHYLUM ECHINODERMATA

Ophiopluteus larvae

PHYLUM CHAETOGNATHA

Sagitta sp.

PHYLUM CHORDATA

Class Larvacea

Oikopleura sp.

Class Osteichthyes

Fish eggs
Fish larvae (unidentified)

Order Anguilliformes

Family Ophicthyidae

Myrophis punctatus leptocephalus

Order Cyprinodontiformes

Family Poeciliidae

Poecilia latipinna

Order Clupeiformes

Family Clupeidae

Brevoortia patronus

Family Engraulidae

Anchoa mitchilli

Order Gobiesociformes

Family Gobiesoridae

Gobiesox strumosus

Order Atheriniformes

Family Atherinidae

Silversides larvae

Order Gasterosteiformes

Family Syngnathidae

Hippocampus zosterae
Syngnathus louisianae
Syngnathus scovelli

Order Perciformes

Family Centrarchidae

Sunfish (juvenile)

Family Carangidae

Chloroscombrus chrysurus

Family Sparidae

Lagodon rhomboides

Family Sciaenidae

Cynoscion nebulosus
Leiostomus xanthurus
Micropogon undulatus

Family Mugilidae

Mugil cephalus

Family Blenniidae

Blenny larvae

Family Gobiidae

Goby larvae
Gobiosoma bosci

Family Stromateidae

Peprilus burti

PHYLUM MISCELLANEOUS

Unidentified larvae

Egg (small, maybe crustacean)

Egg case (green)

Egg case

Table 5. Zooplankton standing crop values *

Line Site	July '73	Aug. '73	Sept.'73	Oct. '73
Nueces Bay				
38-2	459	21,584	20,789	731
53-2	1,671	3,805	5,123	1,283
53-4	1,766	344	8,134	376
64-10	4,620	13,862	2,688	939
$\overline{X}$	2,129	9,899	9,184	832
Corpus Christi Bay				
122-1	1,961	9,577	5,488	11,823
122-6	2,565	2,700	3,152	6,451
122-12	3,030	4,715	5,124	4,106
127-2	748	8,672	6,527	5,435
127-3	2,510	13,130	8,016	3,873
127-6	1,211	8,259	6,670	846
131-2	14,582	21,399	2,934	11,906
142-2	17,675	6,330	31,337	7,509
142-6	4,358	9,317	3,231	5,354
142-10	12,816	28,907	7,954	3,924
147-1	41,909	22,317	16,733	13,214
147-3	3,819	6,320	4,436	15,183
147-5	9,361	26,346	5,542	13,689
151-2	20,766	21,711	27,980	14,677
152-2	7,912	15,820	33,039	15,679
200-2	14,458	12,121	1,934	3,360
$\overline{X}$	9,980	13,603	10,631	8,564
Copano Bay				
44-2	5,927	1,712	3,220	1,259
54-1	1,343	5,487	7,533	2,919
54-3	6,151	9,011	8,133	474
77-2	4,691	2,811	17,318	425
$\overline{X}$	4,528	4,575	9,051	1,269
Aransas Bay				
100-2	12,431	20,455	28,878	2,503
104-2	9,864	10,920	23,492	2,373
104-6	20,215	22,505	39,546	2,509
115-5	16,217	8,473	15,346	10,506
120-3	12,610	19,776	11,350	5,081
141-1	2,170	18,572	9,685	2,287
$\overline{X}$	12,251	16,983	21,383	4,210

* - Counts are individuals per cubic meter
N.S. - No sample taken

Table 5. cont.'d

Line Site	Nov. '73	Dec. '73	Jan. '74	Feb. '74
Nueces Bay				
38-2	341	112,003	128,722	37,953
53-2	811	30,865	117,497	32,462
53-4	N.S.	N.S.	N.S.	N.S.
64-10	11,133	37,443	32,652	24,553,149
x̄	4,095	60,104	92,957	8,207,855
Corpus Christi Bay				
122-1	10,677	14,192	5,350	14,353,683
122-6	N.S.	N.S.	N.S.	N.S.
122-12	5,094	2,408	12,376	1,491,492
127-2	13,197	7,895	5,508	20,373,959
127-3	N.S.	N.S.	N.S.	N.S.
127-6	11,767	9,460	9,002	19,402,859
131-2	11,159	N.S.	N.S.	N.S.
142-2	N.S.	N.S.	N.S.	N.S.
142-6	19,757	36,580	178,088	18,040,224
142-10	N.S.	N.S.	N.S.	N.S.
147-1	37,304	20,899	3,105,339	4,886,993
147-3	N.S.	N.S.	N.S.	N.S.
147-5	45,081	11,659	15,865,757	16,026,008
151-2	21,315	3,984	575,990	40,624
152-2	21,430	7,161	79,754	7,253,223
200-2	15,871	16,352	26,402	32,163
x̄	19,332	13,059	1,986,357	10,190,122
Copano Bay				
44-2	7,450	13,047	18,843	25,292
54-1	9,603	13,687	4,676	12,294
54-3	1,683	10,533	30,530	21,770
77-2	7,564	8,807	14,135	16,725
x̄	6,575	11,519	17,046	19,020
Aransas Bay				
100-2	2,553	4,852	12,093	31,922
104-2	1,524	10,786	12,822	7,280
104-6	2,727	13,202	5,682	28,494
115-5	8,911	7,932	2,798	46,603
120-3	3,255	9,362	2,449	7,580
141-1	7,912	8,840	4,931,828	17,882,196
x̄	4,480	9,162	827,945	3,008,679

* - Counts are individuals per cubic meter
N.S. - No sample taken

increased freshwater inflow. A slight increase in mean standing crop values occurred in August and September, 1973 in all areas which can be correlated with a slight increase in salinities. In October, 1973 a decrease in mean standing crop was noted in all areas corresponding to a decline in salinities. Standing crops increased in Nueces Bay from November, 1973 through February, 1974. The increase from November, 1973 through January, 1974 was due to large numbers of *Acartia tonsa*, and the high standing crop in February was caused by a combination of *A. tonsa* and *Noctiluca scintillans*. In Corpus Christi Bay increases in standing crop from November, 1973 to December, 1973 were due to *A. tonsa* and increases in January and February, 1974 were due mostly to *N. scintillans*. Increases in standing crops at Copano Bay stations from November, 1973 through February, 1974 were caused by large numbers of *A. tonsa* and barnacle nauplii. *A. tonsa* and barnacle nauplii made up the major part of standing crop increases in Aransas Bay from November, 1973 through February, 1974. The high standing crop value at station 141-1 in January and February, 1974 was due to *N. scintillans*.

The effect of salinity changes on the standing crop of brackish water-marine zooplankton and freshwater zooplankton at stations 38-2, 200-2, 44-2 and 54-3 is shown in Table 6. These four stations were chosen to illustrate the effects of freshwater inflow on zooplankton because of their proximity to sources of freshwater inflow. The first major influx of freshwater was noted in June, 1973. From June, 1973 through December, 1973 salinities ranged as follows: 0.4 - 3.6 $^{o}/oo$ at 38-2; 0.2 - 24.2 $^{o}/oo$ at 200-2; 0.0 - 3.3 $^{o}/oo$ at 44-2 and 0.1 - 4.7 $^{o}/oo$ at 54-3. Standing crop values at these stations indicate a decrease in brackish water-marine zooplankton and an increase in

Table 6. Effect of Salinity Changes, $^{o}/oo$, (A) on Standing Crop* of Brackish Water - Marine Zooplankton (B) and Freshwater Zooplankton (C) at Selected Stations.

	Nueces Bay (38-2)			Corpus Christi Bay (200-2)			Copano Bay (44-2)			Copano Bay (54-3)		
	A	B	C	A	B	C	A	B	C	A	B	C
Oct. '72	N.S.	N.S.	N.S.	26.80	2,888	0.0	6.20	8,960	0.0	9.60	7,619	0.0
Nov. '72	N.S.	N.S.	N.S.	29.70	41,155	0.0	9.40	4,897	0.0	9.70	3,484	0.0
Dec. '72	N.S.	N.S.	N.S.	28.40	2,278	0.0	11.40	14,238	0.0	10.50	3,227	0.0
Jan. '73	N.S.	N.S.	N.S.	27.90	2,001	0.0	13.30	694	6.0	11.90	614	0.0
Feb. '73	23.40	2,252	0.0	27.60	66,698	0.0	15.10	10,967	0.0	13.60	17,402	0.0
Mar. '73	26.70	35,195	0.0	28.50	516,933	0.0	15.70	50,513	0.3	16.00	5,796	0.0
Apr. '73	29.30	4,903	0.0	28.40	18,043	0.0	17.30	7,301	0.0	17.10	15,813	0.0
May '73	31.60	6,613	0.0	24.40	28,310	0.0	18.30	6,585	0.0	16.00	18,903	0.0
June '73	3.60	3,047	5,171.0	8.20	37,048	420.0	0.00	124	406.0	0.10	1,684	417.0
July '73	0.60	93	367.0	23.30	14,566	1.0	3.20	5,885	43.0	0.60	6,059	93.0
Aug. '73	1.00	21,517	68.0	24.20	12,142	0.0	3.30	1,719	2.0	4.70	9,012	0.0
Sept.'73	1.10	20,071	718.0	0.20	731	1,175.0	0.40	171	3,049.0	2.00	8,122	12.0
Oct. '73	0.40	65	666.0	3.60	2,721	640.0	0.04	2,721	640.0	0.10	101	374.0
Nov. '73	0.40	170	100.0	14.70	15,872	0.0	1.70	7,449	2.0	1.40	1,676	8.0
Dec. '73	1.30	112,003	1.0	17.20	16,353	0.0	3.10	13,047	0.4	0.90	10,533	0.1
Jan. '74	16.30	128,722	0.3	22.80	26,403	0.0	3.40	18,834	9.0	5.00	30,530	0.0
Feb. '74	9.30	37,935	18.0	23.90	32,165	0.0	6.20	25,297	6.0	4.80	21,764	7.0
Mar. '74	19.20	10,189	3.0	25.80	4,136,052	0.0	8.30	12,146	0.0	6.90	47,115	0.0

* - counts are individuals per cubic meter
N.S. - No Sample Taken

freshwater zooplankton upon initial influx of large amounts of freshwater. The major increases in freshwater inflow as indicated by comparing salinity changes and brackish water-marine versus freshwater zooplankton standing crops occurred as follows: June - July, 1973 and October - November, 1973 at station 38-2; June, 1973 and September - October, 1973 at station 200-2; June, 1973 and September - October, 1973 at station 44-2 and June, 1973 and October, 1973 at station 54-3. Increases in standing crop occur relatively rapidly following declines due to initial salinity drops. This standing crop increase is due to the rapid recovery of large populations of the euryhaline copepod *Acartia tonsa*. From January, 1974 through March, 1974 salinity increased and high standing crops occurred at all four stations.

Tables have been made for some of the more common zooplankters by plotting mean catch values (individuals per cubic meter) for Nueces, Corpus Christi, Copano and Aransas Bays from October, 1972 through March, 1974. These tables show seasonal occurrence and distribution by bay system of the following species: *Acartia tonsa*, *Paracalanus crassirostris*, barnacle nauplii, *Centropages furcatus*, *Centropages hamatus*, and *Noctiluca scintillans* (Tables 7 -12).

A. tonsa is probably the most important estuarine zooplankter because of its ability to survive and reproduce in such a wide range of salinities as are found in an estuarine environment. Its occurrence in large numbers throughout the year makes *A. tonsa* probably the most important secondary producer in the estuaries. Lowest mean catches were taken during October, 1974 which can be correlated with very low salinities. Highest mean catches in Nueces Bay occurred during May and June, 1973 and December, 1973 through February,

Table 7. Mean catch /m^3 for *Acartia tonsa*: October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72	7,430	883	3,823	4,613
Nov. '72	4,175	1,572	3,509	10,742
Dec. '72	4,579	149	2,174	1,328
Jan. '73	1,697	171	147	809
Feb. '73	979	255	159	203
Mar. '73	5,555	3,039	572	1,098
Apr. '73	3,954	1,948	4,542	4,020
May '73	17,518	17,630	9,512	20,657
June '73	13,600	11,595	1,849	6,513
July '73	1,172	4,947	3,461	8,018
Aug. '73	8,386	11,123	4,519	15,766
Sept.'73	8,801	4,493	8,031	20,296
Oct. '73	67	6,322	649	2,381
Nov. '73	1,839	15,670	6,121	2,485
Dec. '73	53,863	5,425	8,088	7,634
Jan. '74	50,333	4,572	9,406	4,068
Feb. '74	13,563	2,106	6,997	4,137
Mar. '74	5,653	14,913	13,011	9,506

Table 8. Mean catch /m^3 for *Paracalanus crassirostris:* October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72	55.0	89.0		18.00
Nov. '72	6.0	206.0	4.0	291.00
Dec. '72	1.0	115.0		12.00
Jan. '73	0.1	10.0		0.02
Feb. '73	36.0	44.0	1.0	7.00
Mar. '73	7.0	133.0	3.0	50.00
Apr. '73		107.0	30.0	58.00
May '73	5.0	306.0	395.0	51.00
June '73		139.0	47.0	713.00
July '73	13.0	171.0		13.00
Aug. '73	38.0	321.0		16.00
Sept.'73	27.0	622.0		6.00
Oct. '73	0.3	264.0		0.20
Nov. '73	32.0	4.2		132.00
Dec. '73	99.0	177.0		6.00
Jan. '74	16.0	143.0		16.00
Feb. '74		243.0		3.00
Mar. '74	23.0	1108.0	3.0	53.00

Table 9. Mean catch /m^3 for barnacle nauplii: October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72	1,898	233	1,489	588
Nov. '72	3,039	267	1,273	593
Dec. '72	2,415	181	5,232	1,401
Jan. '73	1,174	145	2,504	1,105
Feb. '73	1,430	264	52,910	18,553
Mar. '73	10,746	1,620	15,880	9,820
Apr. '73	3,652	3,151	4,267	9,914
May '73	4,343	1,405	3,481	9,708
June '73	1,957	360	788	5,611
July '73	559	258	840	3,656
Aug. '73	314	206	221	561
Sept.'73	283	118	66	751
Oct. '73	21	193	84	1,691
Nov. '73	1,966	153	170	1,510
Dec. '73	2,057	455	2,845	918
Jan. '74	15,607	808	6,226	3,788
Feb. '74	2,379	1,754	11,798	15,013
Mar. '74	3,938	660	5,939	1,745

Table 10. Mean catch /m^3 for *Centropages furcatus*: October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72		0.30		
Nov. '72				
Dec. '72				
Jan. '73				
Feb. '73				
Mar. '73				
Apr. '73				
May '73		0.01		
June '73		9.00		
July '73		17.00		
Aug. '73		8.00		
Sept.'73		2.00		
Oct. '73		0.10		
Nov. '73		0.50		0.4
Dec. '73				
Jan. '74				
Feb. '74				
Mar. '74				

Table 11. Mean catch /m^3 for *Centropages hamatus*: October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72				
Nov. '72		0.02		
Dec. '72	0.2	15.00		7.0
Jan. '73	2.0	116.00	0.10	51.0
Feb. '73	156.0	142.00	2.00	132.0
Mar. '73	22.0	197.00	3.00	16.0
Apr. '73		2.00	0.10	3.0
May '73				
June '73				
July '73				
Aug. '73				
Sept.'73				
Oct. '73				
Nov. '73				
Dec. '73		7.00		0.2
Jan. '74	1.3	241.00		16.0
Feb. '74	6.0	25.00	0.02	1.0
Mar. '74		26.00		0.3

Table 12. Mean catch /m^3 for *Noctiluca scintillans*: October, 1972 - March, 1974 by bay system

	Nueces Bay (25-64)	Corpus Christi Bay (122-200)	Copano Bay (44-77)	Aransas Bay (100-141)
Oct. '72				
Nov. '72				
Dec. '72		8		
Jan. '73	2	3,578		1
Feb. '73	32,135	3,755,142	211	387
Mar. '73	6,393,978	53,649,616	68	6,783
Apr. '73		11	10	
May '73		9		
June '73				
July '73				
Aug. '73				
Sept.'73				
Oct. '73				
Nov. '73				
Dec. '73				
Jan. '74		1,987,942		818,680
Feb. '74	8,189,203	10,184,732	1	2,980,002
Mar. '74	116	1,658,240		

1974. In Corpus Christi Bay the highest mean catches were in May, June, August and November, 1973 and March, 1974. In Copano Bay the highest mean catch values were in May, September and November, 1973 through March, 1974. Highest mean catch values for Aransas Bay were taken in November, 1972 and May, August and September, 1973.

P. crassirostris is less tolerant than A. tonsa to the lower salinities found in Nueces and Copano Bays. It was collected throughout the year and showed a preference for Corpus Christi and Aransas Bays.

Barnacle nauplii occurred throughout the year in all bay systems. The highest mean catches occurred from February to March, 1973 and from January to February, 1974. Although its abundance and common occurrence is comparable to that of A. tonsa, the smaller size of barnacle nauplii and its temporary planktonic existence probably makes it less important as a secondary producer than A. tonsa.

Centropages furcatus is a higher salinity species which was collected during the warm months of October, 1972 and May through November, 1973. Its occurrence is limited mainly to lower Corpus Christi Bay and station 141-1 in Aransas Bay. This indicates that it is brought into the bays by incursions of Gulf water.

Centropages hamatus is a euryhaline species which was collected in all areas during the winter and spring. It occurred from November, 1972 through April, 1973 and from December, 1973 through March, 1974. Highest mean catches were taken in Corpus Christi and Aransas Bay.

Noctiluca scintillans is brought into the bays by incursions of Gulf water in the winter and spring. It was first noted in December, 1972 plankton samples and was present until May, 1973. It was again collected in January, 1974 and was still in the March, 1974 plankton samples. N. scintillans occurred in higher numbers than any other zooplankter collected during this study. It occurred mainly in lower Nueces, all of Corpus Christi and in lower Aransas Bays at station 141-1. Specimens occurred as far up into the estuaries as stations 38-2 and 44-2.

The seasonal occurrences as noted in Tables 7 through 12 gives an indication of the predictability of the occurrences of these common zooplankters. By understanding the annual cycles shown by these animals we should be able to tell what effect given changes in salinity will have on populations of these species.

Species diversity ($\bar{d}$) values for zooplankton samples from October, 1972 through March, 1974 are given in Table 13. They ranged from a high of 3.9027 at 44-2 in June, 1973 to an incredibly low 0.0007 at 122-12 in March, 1973. The values were calculated as described by Holland et al., 1973b. It is now felt that the interpretation of species diversity analysis of zooplankton and phytoplankton data in terms of environmental stress may not always be valid. Other factors, as will be described in the phytoplankton section of this report, are believed to take precedence, at least in the major portion of our study area. A low diversity figure caused by a "bloom" of some sort will always be accompanied by a high redundancy figure (R) as described and calculated by Holland et al., 1973b. Redundancies were calculated for all planktonic and benthic data and invariably in the planktonic data a low diversity is accompanied by a high redundancy value.

Table 13. Species diversity ($\overline{d}$) values for zooplankton samples

Line Site	Oct. '72	Nov. '72	Dec. '72	Jan. '73	Feb. '73
Nueces Bay					
25-2	0.4002	0.7555	0.7556	0.6494	N.S.
38-2	N.S.	N.S.	N.S.	N.S.	1.7262
53-2	2.2653	2.0562	1.1796	1.0242	1.3815
53-4	2.1330	2.2263	0.9647	1.3887	1.4913
64-10	0.9335	2.1010	0.5778	0.9712	0.3064
Corpus Christi Bay					
122-1	1.7372	2.0060	1.6462	1.7863	0.3369
122-2	2.5900	2.0348	2.0449	0.3086	0.1450
122-12	2.4460	2.1546	1.6169	1.0009	0.0008
127-2	2.5468	0.9396	2.4956	2.9881	0.2388
127-3	2.2316	0.4451	0.3877	0.2786	0.0715
127-6	0.6924	1.8593	2.6397	2.4504	0.1641
131-2	2.8459	2.7125	2.1534	2.9411	0.3299
142-2	2.0734	1.9863	2.1576	0.4898	0.4374
142-6	1.7001	1.0199	0.7600	0.7030	0.2406
142-10	1.6623	1.5464	2.6644	0.2467	0.5457
147-1	3.3359	2.1925	2.7832	2.9231	0.8500
147-3	1.7203	2.0003	2.1510	2.0004	0.2951
147-5	1.7259	2.0037	1.5087	0.5807	1.2300
151-2	2.7987	2.3036	2.9973	1.8719	0.5183
152-2	2.6403	2.2713	1.9526	2.2738	2.0297
200-2	2.0029	1.8690	2.1190	2.4976	0.2832
Copano Bay					
44-2	1.2367	2.2006	1.2983	1.1553	0.2629
54-1	0.3746	1.0218	1.3694	0.9248	0.0500
54-3	0.6157	1.2245	1.1145	0.4683	0.0718
77-2	1.4345	1.3146	1.1012	0.9184	0.3889
Aransas Bay					
100-2	1.0765	1.3605	1.5199	1.4347	0.1153
104-2	1.4066	0.7647	1.2493	2.1920	0.6496
104-6	0.9908	1.1102	0.8791	1.2675	1.7439
115-5	1.8953	1.3732	1.3612	1.8603	0.6276
120-3	0.9605	1.3093	0.9430	1.8745	0.3375
141-1	1.5077	1.7965	1.6948	1.7954	1.3186

N.S. - No sample taken

Table 13. cont.'d

Line Site	Mar. '73	Apr. '73	May '73	June '73	July '73
Nueces Bay					
25-2	N.S.	N.S.	N.S.	N.S.	N.S.
38-2	1.6958	1.1535	0.2997	3.0397	3.3049
53-2	0.0110	1.0943	0.5017	0.5822	1.6608
53-4	1.7401	1.1661	0.7196	0.4726	0.7765
64-10	0.9495	1.1569	0.9987	1.0633	1.6084
Corpus Christi Bay					
122-2	1.6775	2.2577	1.2567	2.0754	1.6007
122-6	1.1100	1.7975	0.8046	2.4365	2.2882
122-12	0.0007	1.9588	1.2921	0.6681	2.2861
127-2	1.9924	2.2844	1.0732	2.3030	2.5959
127-3	0.7898	0.6748	0.4152	0.4667	0.7845
127-6	0.0007	2.1669	0.7100	2.2777	2.2708
131-2	1.9006	1.6500	2.2855	2.6439	2.5767
142-2	0.0013	1.6883	2.3341	2.3369	0.5402
142-6	0.1771	2.0389	1.5354	2.0531	1.5387
142-10	2.5937	2.2651	1.6748	2.4252	1.1352
147-1	1.0348	1.7698	1.7484	2.8503	1.7686
147-3	0.3525	2.3585	1.6012	1.6734	2.2836
147-5	1.6390	3.1196	2.6503	2.2238	2.2751
151-2	2.0395	1.8039	1.7650	2.5553	3.3208
152-2	1.2702	2.2429	1.4611	3.1687	2.9163
200-2	1.4057	0.7310	1.6677	1.1874	1.2180
Copano Bay					
44-2	0.1957	0.7866	1.2522	3.9027	0.7933
54-1	0.7958	1.2442	1.2155	1.7859	0.5792
54-3	0.6188	0.9019	1.4915	2.6112	0.4098
77-2	1.2094	1.4936	1.4530	2.0966	1.1385
Aransas Bay					
100-2	1.7796	0.9740	1.2856	1.8976	1.0658
104-2	1.4805	1.8553	1.4946	2.1974	1.3001
104-6	2.0037	1.4037	1.9391	2.7759	0.8424
115-5	0.0018	1.3070	1.1869	1.9333	0.8330
120-3	0.0019	1.5791	1.7647	1.4583	1.0623
141-1	0.0876	2.6735	1.7169	2.9471	1.9902

N.S. - No sample taken

Table 13. cont.'d

Line Site	Aug. '73	Sept.'73	Oct. '73	Nov. '73	Dec. '73
Nueces Bay					
38-2	0.1697	0.4352	3.6268	2.8242	0.2661
53-2	0.4085	1.0075	3.0201	1.8175	1.1340
53-4	0.4869	0.6203	1.0997	N.S.	N.S.
64-10	1.9344	2.0035	2.9771	1.3137	1.1233
Corpus Christi Bay					
122-2	0.8146	2.3155	1.5166	1.3037	1.2014
122-6	2.2768	2.7365	1.1990	N.S.	N.S.
122-12	0.9372	2.3076	1.9857	1.1727	2.8721
127-1	1.7458	1.5490	1.7806	1.0785	1.8965
127-3	1.8368	1.9716	1.8619	N.S.	N.S.
127-6	1.2587	1.3310	2.4726	0.5324	2.0700
131-2	0.9156	1.5521	1.3491	1.1979	N.S.
142-2	1.3248	2.8499	1.1270	N.S.	N.S.
142-6	0.9143	2.9774	0.7264	0.7997	1.8685
142-10	0.5081	1.8379	1.3831	N.S.	N.S.
147-1	1.6911	3.0091	1.6642	1.0249	2.3566
147-3	1.1872	2.0176	1.3960	N.S.	N.S.
147-5	0.5839	3.4069	1.4998	0.6803	1.8194
151-2	1.1902	2.9287	2.1482	2.0633	3.2279
152-2	1.5314	2.0271	1.2086	1.7109	2.9406
200-2	1.8550	2.6117	2.5136	1.0541	1.4512
Copano Bay					
44-2	0.1348	2.3997	3.1945	0.2875	0.9858
54-1	0.1881	0.2337	1.0941	0.1408	1.2085
54-3	0.3193	0.0988	4.0368	0.1611	1.0315
77-2	0.5713	0.3463	2.1259	0.9530	1.2049
Aransas Bay					
100-2	0.7364	0.4606	1.1006	1.3279	0.9035
104-2	0.6539	0.4999	1.2702	1.3136	0.6145
104-6	0.2300	0.1286	1.1673	1.1748	0.8574
115-5	0.2360	0.6338	1.1213	1.3372	0.8489
120-3	0.2732	0.2632	1.0293	1.2147	0.9351
141-1	0.4906	0.2500	0.7200	1.7951	1.3212

N.S. - No sample taken

Table 13. cont.'d

Line Site	Jan. '74	Feb. '74
Nueces Bay		
38-2	0.9351	0.7967
53-2	1.7367	1.7696
53-4	N.S.	N.S.
64-10	1.4750	0.0021
Corpus Christi Bay		
122-2	1.7555	0.0039
122-6	N.S.	N.S.
122-12	2.1799	0.0050
127-2	1.3748	0.0031
127-3	N.S.	N.S.
127-6	1.0688	0.0023
131-2	N.S.	N.S.
142-2	N.S.	N.S.
142-6	0.2417	0.0074
142-10	N.S.	N.S.
147-1	0.0236	0.0116
147-3	N.S.	N.S.
147-5	0.0060	0.0059
151-2	0.0638	0.4038
152-2	0.4260	0.0068
200-2	1.3302	1.8131
Copano Bay		
44-2	1.1258	1.0177
54-1	1.1858	0.7799
54-3	1.2281	0.7523
77-2	0.6890	0.8606
Aransas Bay		
100-2	1.1615	1.6186
104-2	1.2610	0.9395
104-6	1.3455	0.7866
115-5	1.4700	0.3627
120-3	1.0009	0.9874
141-1	0.0464	0.0020

N.S. - No sample taken

PHYTOPLANKTON

Introduction.

The phytoplankton data reported herein covers the period July, 1973 to April, 1974. The previous report covered data from October, 1972 to June, 1973. Comparisons between the two data sets will be made where possible. Due to the ephemeral nature of phytoplankton blooms and to the patchiness of their distributions, one must carefully avoid making too much over a bloom that was present at a spot one year but not the next year. Several fairly obvious patterns of distribution for various phytoplankton species have been observed.

Methods.

Phytoplankton methods are essentially the same as given in the first annual report. Briefly, it entails taking a liter of water from the surface at each station, preserving in buffered formalin, subsampling and counting at 200 power all phytoplankters in the subsample. Subsequent extrapolations to organisms per liter are made. The only major change in phytoplankton methodology for this report was a change in personnel working with phytoplankton. It is recognized that this should make no difference in the data but in reality it may. Two hundred and ninety phytoplankton samples were analyzed during this study period. Ten samples were lost due to breakage in transportation. Plastic jars are now being used which should eliminate this problem.

Results.

One hundred and ninety-one phytoplankton taxa belonging to seven classes have been recognized (Table 14). Most have been identified to genus,

Table 14. Phytoplankton from Corpus Christi and adjacent bay systems

DIVISION CYANOPHYTA
Class Myxophyceae
Order Chroococcales
Anacystis sp.
Gleocapsa sp.
Merismopedia punctata
Merismopedia sp.
Coccoid blue-green
Order Oscillatoriales
Anabaena sp.
Anabaenopsis sp.
Arthrospira sp.
Nostoc sp.
Oscillatoria sp. 1
Oscillatoria sp. 2
Spirulina sp.
Trichodesmium sp.

DIVISION CHLOROPHYTA
Green, unidentified
Class Chlorophyceae
Order Chlorococcales
Ankistrodesmus fulcata
Ankistrodesmus sp.
Chlorococcum sp.
Closteriopsis sp.
Kirchneriella sp.
Oocystis sp.
Pediastrum sp.
Planktospheria sp.
Scenedesmus armatus
Scenedesmus bejuja
Scenedesmus obliquus
Selenastrum gracile
Order Tetrasporales
Ourococcus sp.
Order Vlotrichales
Hormidium sp.
Order Volvocales
Volvox sp.
Order Zygnematales
Arthrodesmus sp.
Cosmarium sp.
Staurastrum sp.

DIVISION EUGLENOPHYTA
Class Euglenophyceae
Order Euglenales
Euglena sp.
Phacus sp.

DIVISION CHRYSOPHYTA

Class Chrysophyceae

Dictyocha fibula
Silicoflagellate, unidentified

Class Bacillariophyceae

Order Centrales

Actinoptychus undulatus
Asteromphalus heptactis
Bacteriastrum delicatulum
Bacteriastrum varians
Bacteriastrum sp.
Biddulphia regia
Biddulphia rhombus
Biddulphia sinensis
Biddulphia sp.
Ceratulina bergonii
Ceratulina pelagica
Ceratulina sp.
Chaetoceros affinis
Chaetoceros atlanticus
Chaetoceros brevis
Chaetoceros coarctatus
Chaetoceros compressus
Chaetoceros constrictus
Chaetoceros curvisetus
Chaetoceros danicus
Chaetoceros decipiens
Chaetoceros didymus
Chaetoceros gracilis
Chaetoceros laciniosum
Chaetoceros lauderis
Chaetoceros peruvianus
Chaetoceros radicans
Chaetoceros socialis
Chaetoceros sp. 1
Chaetoceros sp. 2
Corethron criophylum
Coscinodiscus asteromphalus
Coscinodiscus blandus
Coscinodiscus centralis
Coscinodiscus concinnis
Coscinodiscus excentricus
Coscinodiscus granii
Coscinodiscus lineatus
Coscinodiscus marginatus
Coscinodiscus radiatus
Coscinodiscus sp. 1
Coscinodiscus sp. 2
Cyclotella sp.
Ditylum brightwelli
Eucampia sp.
Guinardia flaccida

Hemiaulus hauckii
Hemiaulus membranaceus
Hemiaulus sinensis
Hemiaulus sp.
Hyalodiscus sp.
Lauderia borealis
Leptocylindrus danicus
Leptocylindrus minimus
Lithodesmium undulatum
Melosira granulata
Melosira moniliformis
Melosira nummuloides
Melosira sulcata
Melosira sp.
Paralia sp.
Rhizosolenia acuminata
Rhizosolenia alata
Rhizosolenia calcar-avis
Rhizosolenia delicatula
Rhizosolenia fragilissima
Rhizosolenia hebeata
Rhizosolenia imbricata
Rhizosolenia robusta
Rhizosolenia setigera
Rhizosolenia shrubsolei
Rhizosolenia stolterforthii
Rhizosolenia styliformis
Rhizosolenia sp.
Skeletonema costatum
Stephanopyxis palmerana
Thallassiosira decipiens
Thallassiosira sp. 1
Triceratium sp.

Order Pennales

Amphiphora gigantea
Amphora sp.
Asterionella japonica
Bacillaria sp.
Caloneis sp.
Campylodiscus sp.
Cocconeis scutellum
Cocconeis sp.
Cymbella sp.
Denticula sp.
Diatoma sp.
Diploneis sp.
Fragilaria sp.
Grammatophora sp.
Gyrosigma balticum
Gyrosigma sp.
Licmorpha abbreviata
Licmorpha sp.

Navicula clavata
Navicula spuria
Navicula sp. 1
Navicula sp. 2
Navicula sp. 3
Nitzschia amphioxys
Nitzschia closterium
Nitzschia delicatissima
Nitzschia distans
Nitzschia longissima
Nitzschia lorenziana
Nitzschia pacifica
Nitzschia paradoxa
Nitzschia pugens
Nitzschia seriata
Pinnularia sp.
Plagiogramma sp.
Pleurosigma angulatum
Pleurosigma decorum
Pleurosigma sp.
Striatella sp.
Surirella gemma
Surirella sp.
Synedra sp.
Tabellaria sp.
Thallasionema nitzchioides
Thallasionema nordskii
Thallasiothrix delicatula
Thallasiothrix frauenfeldii
Thallasiothrix longissima
Thallasiothrix mediterranea
Tropidoneis lepidoptera
Tropidoneis maxima
Tropidoneis sp.

DIVISION PYRROPHYTA

Dinoflagellate, unidentified

Class Desmophyreae

Order Prorocentrales

Exuviaella compressa
Exuviaella sp.
Prorocentrum gracile
Prorocentrum micans
Prorocentrum scutellum
Prorocentrum sp.

Class Dinophyceae

Order Dinophysalidales

Dinophysis caudata
Dinophysis sp.

Order Peridiniales

Ceratium furca

Ceratium fusus
Ceratium hircus
Ceratium pentagonum
Ceratium tripos
Glenudinium sp.
Gonyaulax monilata
Gonyaulax sp.
Oxytoxum sp.
Peridinium claudians
Peridinium conicum
Peridinium divergens
Peridinium oblongum
Peridinium sp.
Podolampas elegans

with many taken to species. Four are as yet unidentified and are given descriptive labels, eg. coccoid blue-green.

The division Chrysophyta is by far the most abundant taxon of phytoplankters represented in our samples. Diatoms comprise approximately 70% of the taxa recognized. The dinoflagellates (Pyrrophyta) are taxonomically our second most abundant phytoplankters but are closely followed by the greens (Chlorophyta). The least abundant division is that of Euglenophyta which is predominately a fresh-water group and is probably accidental in our samples.

Phytoplankton standing crop data measured in individuals per liter are given in Table 15. Standing crops vary widely between stations and months. All sites are grouped into four major areas by bay, admittedly a somewhat artificial grouping due to large hydrographic variations within each bay. The standing crop means per bay show some basic trends of phytoplankton populations within these bays, but these may be strongly influenced by blooms at single stations in each bay. Individual samples range from a low of 150 ind./liter at station 53-2 in September, 1973 to a high of 3,130,000 ind./liter at station 122-1 in December, 1973.

Species diversity ($\bar{d}$) values for all phytoplankton data thus far collected (October, 1972 - April, 1974) are given in Table 16. The present study period high $\bar{d}$ value was 3.8971 at 127-2 in March, 1974; the low value was 0.0467 at 54-3 in February, 1974. Comparing October, 1972 - April, 1973 values to October, 1973 - April, 1974 values, one sees a general picture of higher diversity values at most stations during the first study period. This is apparently particularly true through the fall and winter months with some

Table 15. Phytoplankton standing crop values *

Line Site	July '73	Aug. '73	Sept. '73	Oct. '73	Nov. '73
Nueces Bay					
38-2	5,340	111,600	7,150	60,600	56,383
53-2	2,320	71,662	150	32,000	37,946
53-4	2,880	146,433	104,200	172,114	16,368
64-10	5,760	40,825	16,100	55,680	24,639
$\bar{x}$	4,075	92,630	47,988	72,898	33,834
Corpus Christi Bay					
122-1	10,240	14,450	1,990	64,600	169,609
122-6	44,560	24,991	8,195	58,120	92,000
122-12	32,100	277,114	63,800	41,065	152,702
127-2	11,640	26,400	151,920	206,000	84,687
127-3	63,120	154,750	1,900	185,750	151,963
127-6	155,160	116,400	30,076	54,384	41,217
131-2	83,760	105,400	N.S.	27,078	118,206
142-2	68,130	77,200	273,000	32,400	145,860
142-6	7,760	38,800	72,400	12,000	121,933
142-10	131,600	49,689	93,637	25,337	151,419
147-1	374,220	89,090	304,000	96,500	68,250
147-3	248,000	98,000	66,500	83,750	72,000
147-5	64,890	46,900	10,150	22,315	96,053
151-2	84,300	53,328	118,000	156,500	104,720
152-2	160,830	69,800	51,200	48,992	93,886
200-2	42,000	55,000	22,300	13,280	20,545
$\bar{x}$	98,894	81,082	79,804	70,504	105,315
Copano Bay					
44-2	3,500	79,200	17,163	12,050	62,830
54-1	1,040	8,650	2,600	7,750	12,600
54-3	37,600	14,700	29,300	9,350	52,904
77-2	1,440	2,750	8,450	26,300	7,300
$\bar{x}$	10,895	26,325	14,378	13,862	33,908
Aransas Bay					
100-2	1,760	2,550	29,300	827,496	9,900
104-2	640	56,516	7,500	33,326	47,200
104-6	2,320	1,880	18,480	31,500	59,313
115-5	2,480	47,722	N.S.	65,625	95,715
120-3	560	2,050	58,628	90,800	33,672
141-1	2,970	12,400	46,663	25,630	10,080
$\bar{x}$	1,788	20,520	28,677	179,062	42,646

N.S. - No sample taken
* - Counts are individuals per liter

Table 15. cont.'d

Line Site	Dec. '73	Jan. '74	Feb. '74	Mar. '74	April '74
Nueces Bay					
38-2	54,435	139,980	15,600	3,100	20,900
53-2	107,934	11,681	194,000	11,800	27,600
53-4	27,658	21,693	88,250	5,200	11,500
64-10	80,367	23,940	258,500	9,500	4,000
$\bar{x}$	67,598	49,323	139,087	7,400	76,000
Corpus Christi Bay					
122-1	3,130,000	17,916	98,100	243,295	12,500
122-6	103,199	70,458	37,000	65,148	26,750
122-12	1,045,038	327,838	16,500	222,497	7,850
127-2	2,700,500	17,976	24,000	48,600	7,700
127-3	1,875,000	65,220	9,216	125,835	7,800
127-6	1,553,329	122,880	6,720	174,997	263,000
131-2	1,840,000	N.S.	9,222	86,800	7,900
142-2	82,610	22,160	25,221	2,601	15,200
142-6	2,617,500	144,998	509	21,600	4,600
142-10	113,725	107,683	14,300	69,000	3,300
147-1	66,829	61,414	8,750	30,000	171,300
147-3	46,993	283,250	13,750	71,000	9,100
147-5	135,250	27,654	2,200	98,334	N.S.
151-2	62,370	5,981	7,800	147,509	40,900
152-2	25,304	39,900	5,328	60,000	75,600
200-2	1,268,000	12,272	34,958	70,800	4,848
$\bar{x}$	1,041,602	88,506	19,597	96,126	43,889
Copano Bay					
44-2	288,791	N.S.	56,350	405,818	294,400
54-1	13,948	11,000	2,650	290,867	1,050
54-3	37,409	8,800	130,004	773,000	350
77-2	29,090	400	12,050	118,400	50,264
$\bar{x}$	92,309	6,733	50,263	397,021	86,516
Aransas Bay					
100-2	108,500	75,600	11,424	7,100	4,500
104-2	22,110	18,772	9,072	6,552	15,950
104-6	N.S.	43,888	9,792	35,148	17,550
115-5	36,659	61,991	40,032	4,300	6,216
120-3	82,836	16,752	29,088	77,875	29,300
141-1	97,897	76,036	4,650	167,000	53,202
$\bar{x}$	69,600	48,839	17,343	49,662	21,119

N.S. - No sample taken
* - Counts are individuals per liter

Table 16. Species diversity ($\bar{d}$) values for phytoplankton samples

Line Site	Oct. '72	Nov. '72	Dec. '72	Jan.'73	Feb. '73
Nueces Bay					
25-2	3.0779	2.1579	2.1958	1.1604	N.S.
38-2	N.S.	N.S.	N.S.	N.S.	2.1985
53-2	1.7502	2.5662	3.1378	1.1913	1.6629
53-4	2.8427	0.2098	1.0493	1.6125	2.3074
64-10	0.0213	2.3074	2.5328	1.7216	2.1169
Corpus Christi Bay					
122-1	2.4409	2.4606	2.7257	2.6846	1.3139
122-6	3.2059	2.3468	3.2570	2.3748	1.8214
122-12	3.2758	3.6827	3.0924	1.7713	2.4448
127-2	3.4205	2.7609	2.7625	2.1510	1.3735
127-3	3.4899	2.6197	2.1019	1.9126	1.3192
127-6	3.3983	3.4720	2.4553	1.2478	1.1147
131-2	3.1590	1.6929	2.9790	2.5439	1.0638
142-2	3.3435	3.0980	2.6477	1.8337	1.2700
142-6	3.0745	3.2354	2.3152	1.0845	1.2212
142-10	3.0139	2.2905	2.6276	0.8847	1.3574
147-1	3.8587	3.1852	2.4113	1.9699	0.9853
147-3	3.4177	3.2299	3.0563	1.8300	1.3089
147-5	3.3140	3.7839	2.6963	2.4332	1.3790
151-2	3.9395	3.5158	3.2631	2.7446	1.0563
152-2	3.3396	3.1086	2.3266	2.3255	1.6463
200-2	2.2466	3.3741	2.8673	1.8274	1.5596
Copano Bay					
44-2	0.9358	2.6224	2.4616	0.2863	2.6628
54-1	1.4222	2.2658	1.3789	0.9695	2.1292
54-3	2.0156	2.6641	1.0584	1.4212	0.7223
77-2	2.1429	1.5505	2.2337	1.6301	1.5451
Aransas Bay					
100-2	1.1783	3.1135	1.9801	2.2403	1.0538
104-2	1.8085	1.1766	*	1.9117	2.2416
104-6	1.4847	1.9944	2.0967	2.3535	1.1388
115-5	1.9279	1.9067	2.2443	1.7371	1.2502
120-3	1.0569	1.4058	2.0267	1.8349	2.4680
141-1	2.4774	1.1059	2.0779	1.6072	1.7649

N.S. - No sample taken

Table 16. cont.'d

Line Site	Mar. '73	Apr. '73	May '73	June '73	July '73
Nueces Bay					
25-2	N.S.	N.S.	N.S.	N.S.	N.S.
38-2	1.6866	1.8922	2.3518	1.9930	2.4674
53-2	0.6188	0.3827	1.4793	0.9794	1.2849
53-4	1.1676	2.1556	2.2477	1.5362	2.0685
64-10	1.4321	1.6011	2.9449	2.2258	2.0529
Corpus Christi Bay					
122-1	2.0443	1.9793	2.1249	3.4621	2.0349
122-6	1.4360	2.6384	2.6663	1.7906	1.5875
122-12	1.2610	2.6841	2.3442	1.8408	1.5005
127-2	1.8352	0.3272	2.8132	3.6063	2.1725
127-3	1.8969	1.2139	2.6580	2.4113	1.6952
127-6	1.5755	2.7224	2.5119	2.9056	1.6023
131-2	1.5344	1.3846	2.1471	3.0980	2.5136
142-2	1.6648	2.6882	1.9249	2.5072	1.5424
142-6	1.4077	1.6161	2.8362	2.2006	3.4792
142-10	0.9570	2.5201	3.1031	2.7457	1.6153
147-1	1.7876	2.7004	1.9887	2.5834	2.0009
147-3	1.1884	2.6662	1.5317	2.0944	1.6862
147-5	0.3231	2.2251	1.9375	0.6305	1.2236
151-2	1.8074	0.8810	1.0592	3.0212	2.4172
152-2	1.6393	2.5731	1.5949	3.1114	1.7646
200-2	1.2374	2.2501	2.1005	2.1434	2.1907
Copano Bay					
44-2	0.9853	1.8145	1.3379	2.2610	N.S.
54-1	2.3066	0.9613	2.3582	1.3691	*
54-3	2.1913	0.7625	1.6728	0.3740	0.1996
77-2	2.5611	2.3314	1.8687	2.3971	1.1983
Aransas Bay					
100-2	0.4073	1.4714	2.1450	2.0318	0.7733
104-2	2.7205	1.5712	0.7774	2.1585	1.5489
104-6	2.5419	0.4263	1.0101	2.1721	1.6661
115-5	2.5970	0.8374	1.2945	2.8534	0.9475
120-3	2.9263	0.4432	1.7570	1.5887	1.8425
141-1	1.2011	2.1121	1.3288	2.5816	1.6417

N.S. - No sample taken

* - Only 1 species present, no value calculated

Table 16. cont.'d

Line Site	Aug. '73	Sept.'73	Oct. '73	Nov. '73	Dec. '73
Nueces Bay					
25-2	N.S.	N.S.	N.S.	N.S.	N.S.
38-2	1.5066	1.1116	2.6771	3.4399	2.4888
53-2	0.3158	*	3.6767	2.6106	2.2579
53-4	1.2415	1.5074	3.6180	2.9283	1.2062
64-10	3.1486	0.4500	3.1669	3.2398	0.6603
Corpus Christi Bay					
122-1	2.9124	1.0586	1.3272	1.7881	0.2720
122-6	3.2628	2.2421	1.7874	2.0251	0.2043
122-12	2.1462	2.1060	2.1759	2.4374	0.4940
127-2	3.1194	1.6319	1.7589	2.3392	0.4469
127-3	1.3194	*	1.9509	2.4257	0.8378
127-6	2.5104	1.8468	2.0486	1.8275	1.1190
131-2	3.1214	N.S.	1.9649	2.2031	0.5170
142-2	2.8497	2.2118	1.8683	2.4370	0.7632
142-6	2.3184	2.5594	2.0150	2.4197	0.5113
142-10	2.3328	2.8713	1.2354	2.2873	0.5220
147-1	3.2483	1.2741	2.1175	2.4993	0.7769
147-3	2.8781	1.1983	2.0410	2.5977	0.9166
147-5	3.0178	1.9910	1.6056	2.5583	1.7368
151-2	3.0296	1.6130	2.2507	3.4588	0.9544
152-2	2.4638	1.0568	2.0923	3.0182	1.7359
200-2	2.9649	1.3373	1.4241	2.6506	0.7644
Copano Bay					
44-2	1.8470	0.7416	2.5738	1.3899	0.7251
54-1	1.3594	1.3491	1.9540	1.5579	1.5983
54-3	2.2060	1.6112	2.3471	2.5829	2.2821
77-2	0.8935	2.3097	1.5506	1.2090	2.0695
Aransas Bay					
100-2	2.0748	0.8455	0.2413	1.9397	0.8888
104-2	1.6360	1.7490	1.1218	0.3721	1.8024
104-6	2.2989	2.1695	1.6963	0.9642	N.S.
115-5	1.5045	N.S.	1.0812	0.5510	2.7689
120-3	2.4254	0.7687	2.4942	0.0564	1.3714
141-1	2.8250	1.5756	0.3476	2.6398	2.0783

N.S. - No sample taken
* - Only 1 species present, no value calculated

Table 16. cont.'d

Line Site	Jan. '74	Feb. '74	Mar. '74	Apr. '74
Nueces Bay				
25-2	N.S.	N.S.	N.S.	N.S.
38-2	1.9973	0.9829	2.6793	1.8476
53-2	2.2675	3.1971	0.7792	1.2127
53-4	1.2472	3.1554	1.8091	2.2476
64-10	0.4902	2.8969	2.8048	0.8001
Corpus Christi Bay				
122-2	1.9775	1.6778	2.0481	1.1790
122-6	2.2413	2.1520	3.1258	1.0338
122-12	0.7912	2.4176	3.1468	0.6250
127-2	1.9915	1.5136	3.8971	2.4275
127-3	1.7783	1.5504	2.6780	1.1387
127-6	2.2704	2.2166	3.3317	0.4119
131-2	N.S.	1.6737	2.5393	1.5731
142-2	2.6168	2.3544	2.0690	3.8245
142-6	1.8496	2.2461	3.6743	3.0603
142-10	2.1192	2.2253	3.5783	2.0099
147-1	2.3304	2.3332	1.7522	1.8333
147-3	1.4662	1.8287	3.4243	2.5714
147-5	2.7235	2.1983	1.7712	N.S.
151-2	2.0676	1.9973	3.2912	3.4435
152-2	2.0575	1.2637	1.9528	3.0848
200-2	1.0973	1.6491	2.2992	1.5897
Copano Bay				
44-2	N.S.	1.1386	0.6787	0.0175
54-1	1.3314	2.3365	0.0556	2.0090
54-3	0.1565	0.0467	0.0821	1.8425
77-2	1.5001	1.3309	0.7265	0.9803
Aransas Bay				
100-2	1.4690	2.2433	2.0877	2.1335
104-2	2.3225	2.6884	2.9993	1.8562
104-6	2.3075	2.6988	1.3430	2.3435
115-5	1.1429	2.4913	2.3703	2.1621
120-3	2.0188	2.0927	1.6961	2.0293
141-1	1.8066	2.5937	2.9251	3.5156

N.S. - No sample taken

leveling out in the spring (February - April). During the first study period, there was no single month in which most of the $\overline{d}$ values plummeted. This definitely occurred in December, 1973 of the present report period. This decrease in $\overline{d}$ values was caused by a tremendous bloom of Thalassiothrix frauenfeldii, a pennate diatom, which was particularly evident in Corpus Christi Bay. It should be noted that this bloom was not evident at the lower salinity stations (upper Nueces and Copano Bays). Station 44-2 (upper Copano Bay) showed a decided decrease in $\overline{d}$ value in December, 1973 but this was due to a bloom of Anabaena rather that T. frauenfeldii. T. frauenfeldii was present at most stations in Corpus Christi Bay throughout the study period. It began increasing in dominance in October, 1973 and reached its peak in December, 1973 then rapidly diminished at most stations. Its bloom was diminished at the lower Nueces stations and non-existent at 38-2. The T. frauenfeldii bloom never materialized at any of the Aransas or Copano Bay stations. The organism was found in limited numbers at some stations in Aransas Bay and was essentially absent from Copano Bay.

Species diversity values were lowered at many stations generally indicating the effect of a bloom or high dominance of some phytoplankter. Oscillatoria sp., Anabaena sp., an unidentified blue-green filament, Nitzchia seriata, Navicula sp., Merismopedia punctata and Hormidium sp. all showed blooms of varying intensities in either Copano or Aransas Bays. It is interesting to note that only two of these organisms (N. seriata & Navicula sp.) are diatoms.

Discussion.

Several problems arise when trying to interpret phytoplankton data such as has been collected during this study. As has been noted, the diatoms and dinoflagellates make up the bulk of our taxonomic list and are usually dominant in our samples. Before one can really interpret population dominance, importance of various producers and general importance of phytoplankton as evidenced by standing crop values, we must realize that we may be observing only a fraction of the total phytoplankton population. First, many estuarine phytoplankters are too small to be seen using our counting techniques. These nannoplankters may have a profound effect on our estimates of total phytoplankton populations. Diatoms preserve very well whereas other more fragile forms do not. Also, as we have noted in our collections, the distribution of phytoplankton populations is often very sparse and patchy spatially. We may miss plankton blooms that are occurring at other than our sampling sites. The temporal distribution of phytoplankton is such that a bloom could occur and dissipate between our collection periods.

Our findings are generally consistent with other net phytoplankton studies done along the Texas Gulf coast. Moseley (1971) found diatoms and dinoflagellates to be his most abundant phytoplankters. He lists 146 species of phytoplankters found in Cox Bay, limiting his list to diatoms and dinoflagellates. Matthews et al. (1974) found 91 taxa of phytoplankters. They apparently also had a dominance of Chrysophyta with Chlorophyta being next dominant followed by the dinoflagellates (Pyrrophyta). They, however, were working with live samples and it is possible that the preservation factor is responsible for their seeing more Chlorophyta. Another possible factor is that they are working in a much lower salinity regime than we are. We tend to get more greens and blue-greens at our sites of lower salinity.

The major phenomenon in phytoplankton distribution during this report period was the bloom of <u>T.</u> <u>frauenfeldii</u> in Corpus Christi Bay. The average standing crop for the sixteen stations in this bay was 1,041,602 ind./liter for the month of December, 1973 (Table 15). The bloom did not extend into any of the other bays in the system. The average temperature for all bays during the months of October, November and December, 1973 was very similar. It ranged from around 21°C. in October to around 15°C. in December. Therefore, there is no reason to believe that temperature was a factor in keeping this bloom out of Nueces, Copano and Aransas Bays. A definite salinity differential did occur between Corpus Christi and the other three bays during this period, however. Average salinities in Corpus Christi Bay ranged from 14.1 to 19.4 ppt. for the last three months of 1973. Average salinities in the other three bays ranged from 1.2 to 9.6 ppt. Turbidities in Copano, Aransas and Nueces Bays averaged about double those found in Corpus Christi Bay during the sample period. There were no apparent nutrient effects seen with this bloom. It appears that the bloom was limited to Corpus Christi Bay by the low salinities found in the other bays and perhaps was influenced also by the lower turbidity found in Corpus Christi Bay. It is interesting to note that the *T. frauenfeldii* bloom did not occur in the first report period. An examination of the hydrographic data from the October - December, 1972 period shows a wider temperature range (28°C. in October to 8°C. in December) and a much higher salinity regime. There should have been no salinity barrier to its spread but it did not occur.

Species diversity ($\bar{d}$) values were calculated and reported in Table 16. Generally, usage of species diversity analysis is an attempt to see environmental pressure of some sort. We feel that this is not a valid usage of phytoplankton data. Many papers (Holland et al., 1973b) document the use of species diversity values for benthic populations as an indication of environmental stress. This is based on the general concept that benthic populations seem to respond to environmental pressures according to a time-stability theory of population gradients. This concept is discussed by Krebs, 1972 for polar-tropical population gradients. For estuarine usage, one observes highly diverse benthic populations in estuarine areas of relatively high environmental stability where such populations have been relatively undisturbed through time by environmental pressure. Less diverse benthic populations are encountered in areas of high environmental stress and less time between stressing situations for much the same reasons as given by Krebs for polar-tropical populations. This does not appear to be the case with either phytoplankton or zooplankton populations. These populations move with the water column and have a relatively short life span compared to benthic populations. No gradient appears that can be interpreted as stress, particularly man-made stress, from an examination of the phytoplankton diversity data. Krebs lists several other theories of polar-tropical community gradients which might well explain the diversity of phytoplankton communities better than a time-environmental stability hypothesis. He lists three that are particularly interesting. The theories of spatial heterogeneity, prey-predation and competition, either singly or in some combination, may well provide the key to understanding planktonic community structure through species diversity analysis. These will be discussed in greater detail in the final report. It is not believed that low diversity figures necessarily indicate stressful conditions for phytoplankton populations in our study area, although this may be true for other areas. Our lowest diversity figures came with huge blooms of *T. frauenfeldii*. Invariably, lowered diversity figures indicate dominance of some phytoplankter in the sample, if not a distinct bloom. There is a technique for quantifying the dominance within a sample. This redundancy figure (R) has been calculated for all data thus far collected by methods described in Holland et al., 1973b. This data was used in conjunction with species diversity figures.

BENTHOS

Introduction.

Benthos data contained in this report was collected during the second ten month period of this study. Some data is given from the initial report period that was not included in the first report.

Methods.

The collection and analysis of benthic samples continued through this second period with little change in technique. Several additions were made procedurally which we hope will enhance the understanding of benthic populations in our study. We have begun a more extensive study of the bottom sediments at each site and have begun the use of cluster analysis on selected segments of the benthos data. The collection and taxonomic procedures remain basically unchanged from the first report period.

Results.

Three hundred and thirty eight benthic taxa have been collected and identified as far as taxonomic expertise available to us will allow (Table 17). Certain phyla, eg. Porifera, Nematoda and Rhynchocoela, are so little known or difficult to identify that our identifications of these groups are minimal. Most of the other taxa are identified to species, some are left primarily at genus (eg. amphipods) while occasionally they are identified only to family.

Standing crop values, measured as the number of individuals per ½ cubic foot of sediment, are given in Table 18. They may be compared with Table 3 from the first report. Mean standing crops from the various bays differ. Corpus Christi Bay stations generally have the highest mean standing crop

Table 17. Benthic animals from Corpus Christi and adjacent bay systems.

PHYLUM PORIFERA

Sponge A

PHYLUM COELENTERATA

Class Anthozoa

Haliplanella luciae
Paranthus rapiformis
Anemone, Burrowing A
Anemone, Burrowing B

PHYLUM PLATYHELMINTHES

Class Turbellaria

Stylochus ellipticus
Flatworm A

PHYLUM NEMATODA

Nematode A
Nematode B

PHYLUM RHYNCHOCOELA

Cerebratulus lacteus
Nemertean A (white)
Nemertean B (yellow bands)
Nemertean C (black bands)
Nemertean D (purple, yellow)
Nemertean E (green eyes)
Nemertean F (2 eyes)
Nemertean G (4 eyes)
Nemertean H (wide black bands, red neck, 2 rows of eyespots)

PHYLUM ANNELIDA

Class Oligochaeta

Peloscolex cf. *gabriella*
Oligochaeta A

Class Polychaeta

Order Errantia

Family Polynoidea

Harmothoe aculeata
Lepidasthenia commensalis
Lepidonotus variabilis
Polynoid A

Family Sigalonidae

Sthenelais boa

Family Chrysopetelidae

Paleanotus heteroseta

Family Amphinomidae

Psuedeurythoe sp.
Amphinomid A
Amphinomid B

Family Phyllodicidae

Anaitides erythrophyllus
Eteone heteropoda
Eteone lactea
Eumida sanguinea
Nereiphylla fragilis
Paranaitis speciosa

Family Hesionidae

Gyptis vittata
Parahesione luteola
Podarke obscura

Family Pilargidae

Ancistrosyllis jonesi
Ancistrosyllis papillosa
Parandalia fauveli
Sigambra bassi
Sigambra ocellata
Sigambra tentaculata
Synelmis albini

Family Syllidae

Autolytus prolifer
Brania clavata
Exogone dispar
Syllis cornuta
Syllis gracilis
Synsyllis longicularis
Typosyllis corallicoloides

Family Nereidae

Ceratonereis irritabilis
Ceratonereis mirabilis
Ceratonereis tridentata
Laeonereis culveri
Namalycastis abuima
Nereis succinea
Nereidae, unidentified

Family Nephtyidae

Aglaophamus verrilli
Nephtys bucera
Nephtys picta

Family Glyceridae

Glycera americana

Family Goniadidae

Glycinde solitaria

Family Onuphidae

Diopatra cuprea
Onuphis eremita oculata

Family Eunicidae

Lysidice ninetta
Marphysa sanguinea

Family Lumbrineridae

Lumbrinereis parvipedata

Family Arabellidae
Drilonereis magna
Family Dorvilleidae
Dorvillea sociabilis
Stauronereis rudolphi
Order Sedentaria
Family Orbiniidae
Scoloplos foliosus
Scoloplos fragilis
Scoloplos robustus
Scoloplos rubra
Scoloplos sp. nov.
Family Paraonidae
Aricidea fragilis
Aricidea sp.
Family Spionidae
Apoprionospio pygmaea
Dispio uncinata
Minuspio cirrifera
Polydora caulleryi
Polydora commensalis
Polydora hamata
Polydora ligni
Polydora quadrilobata
Polydora socialis
Polydora websteri
Prionospio heterobranchia
Prionospio pinnata
Prionospio tenuis
Prionospio treadwelli
Scolecolepides viridis
Scolelepis texana
Spio setosa
Spiophanes bombyx
Streblospio benedicti
Malacoceros indicus
Family Magelonidae
Magelona pettiboneae
Family Chaetopteridae
Spiochaetopterus oculatus
Family Cirratulidae
Tharyx setigera
Family Cossuridae
Cossura delta
Family Flabelligeridae
Piromis roberti
Family Opheliidae
Armandia agilis
Family Capitellidae
Capitella capitata
Capitellides jonesi
Capitomastus aciculatus
Heteromastus filiformis
Mediomastus californiensis
Notomastus hemipodus

Notomastus latericeus
Notomastus sp.
Scyphoproctus platyproctus
Family Maldanidae
Branchioasychis americana
Clymenella mucosa
Clymenella torquata calida
Family Oweniidae
Owenia fusiformis
Family Sabellaridae
Sabellaria vulgaris
Family Pectinariidae
Pectinaria gouldi
Family Ampharetidae
Melinna maculata
Family Terebellidae
Loimia medusa
Pista palmata
Thelepus setosus
Family Sabellidae
Chone duneri
Megalomma bioculatum
Sabella melanostigma
Sabella micropthalma
Sabellid A
Family Serpulidae
Eupotamus dianthus
Pomatoleios kraussi
Sphaeropomatus miamiensis

PHYLUM MOLLUSCA
Class Amphineura
Family Ischnochitonidae
Ischnochiton papillosus
Class Gastropoda
Family Hydrobiidae
Littoridina sphinctosoma
Family Truncatellidae
Truncatella pulchella
Family Vitrinellidae
Anticlimax pilsbryi
Teinostoma biscayense
Teinostoma parvicallum
Vitrinella helicoidea
Family Caecidae
Caecum glabrum
Family Cerithiopsidae
Cerithiopsis emersonii
Cerithiopsis greeni
Seila adamsi
Family Epitonidae
Epitonium multistriatum
Epitonium rupicola

Family Calyptraeidae

Crepidula fornicata

Crepidula plana

Family Naticidae

Polinices duplicatus

Family Columbellidae

Anachis avara

Anachis obesa

Mitrella lunata

Family Buccenidae

Cantharus cancellarius

Family Melongenidae

Busycon contrarium

Family Nassariidae

Nassarius vibex

Family Olividae

Olivella dealbata

Family Pyramidellidae

Pyramidella crenulata

Odostomia bisuturalis

Odostomia gibbosa

Odostomia laevigata

Odostomia teres

Turbonilla elegantula

Turbonilla cf. *hemphilli*

Family Acteonidae

Acteon punctostriatus

Family Atyidae

Haminoea succinea

Family Retusidae

Retusa canaliculata

Order Nudibranchia

Coryphella sp.

Doridella obscura

Elysia sp.

Polycerella cf. *emersonii*

Nudibranch A

Nudibranch B

Class Scaphopoda

Dentalium texasianum

Class Pelecypoda

Family Nuculidae

Nuculana acuta

Family Arcidae

Anadara ovalis

Anadara transversa

Family Mytilidae

Amygdalum papyria

Brachidontes citrinus

Brachidontes exustus

Brachidontes recurvus

Family Veneridae

Anomalocardia cuneimeris
Cyclinella tenuis
Dosinia elegans
Mercenaria campechiensis
Mercenaria mercenaria
Pitar texasiana

Family Petricolidae

Petricola pholadiformes

Family Corbulidae

Corbula contracta
Corbula krebsiana
Corbula swiftiana
Varicorbula operculata

Family Hiatellidae

Hiatella arctica

Family Pholadidae

Barnea truncata
Cyrtopleura costata
Diplothyra smythi

Family Pandoridae

Pandora trilineata

Family Periplomatidae

Periploma inequale

Family Lyonsiidae

Lyonsia hyalina floridana
Pelecypod A

PHYLUM ARTHROPODA

Class Pycnogonida

Pycnogonid A

Class Crustacea

Order Myodocopa

Sarsiella spinosa
Sarsiella texana
Sarsiella zostericola

Order Calanoida

Acartia tonsa+
Labidocera aestiva+
Pseudodiaptomus coronatus+
Calanoid copepod A

Order Harpacticoida

Alteutha depressa
Canuella canadensis+
Ectinosoma elongata+
Longipedia coronatus+

Order Cyclopoida

Giardella sp.
Hemicyclops sp.
Cyclopoid Copepod A (commensal in *Mulinia*)
Cyclopoid Copepod B

Family Pinnidae

Atrina seminuda

Family Pectinidae

Aequipecten amplicostatus

Family Anomiidae

Anomia simplex

Family Ostreidae

Crassostrea virginica

Family Lucinidae

Lucina multilineata

Phacoides pectinatus

Family Ungulinidae

Diplodonta semiaspera

Diplodonta cf. *soror*

Family Kelliidae

Mysella planulata

Family Leptonidae

Leptonid A

Family Sportellidae

Aligena texasiana

Family Cardiidae

Laevicardium mortoni

Trachycardium muricatum

Family Mactridae

Anatina anatina

Mulinia lateralis

Rangia cuneata

Rangia flexuosa

Family Solenidae

Ensis minor

Family Tellinidae

Macoma brevifrons

Macoma constricta

Macoma mitchelli

Macoma tenta

Tellina alternata

Tellina iris

Tellina tampaensis

Tellina texana

Tellina versicolor

Tellidora cristata

Family Psammobiidae

Sanguinolaria cruenta

Family Solecurtidae

Tagelus divisus

Family Scrobiculariidae

Abra aequalis

Family Semelidae

Congeria leucophoeta

Cumingia tellinoides

Order Thoracica

Balanus eburneus

Order Mysidacea

Mysidopsis almyra
Mysidopsis bigelowi
Bowmaniella brasiliensis

Order Cumacea

Cyclaspis varians
Diastylis sculpta
Oxyurostylis salinoi
Cumacean A

Order Tanaidacea

Leptochelia rapax

Order Isopoda

Cassidinidea lunifrons
Cleantis planicaudata
Cymodoce faxoni
Edotea triloba
Edotea montosa
Erichsonella attenuata
Sphaeroma quadridentatum
Isopod A

Order Amphipoda

Acanthohaustorius sp.
Ampelisca abdita
Ampelisca holmesii
Aoridae
Atylus sp.
Caprellid A
Cerapus tubularis
Corophium louisianum
Corophium ascherusicum
Cymadusa sp.
Elasmopus cf. *levis*
Ericthonius brasiliensis
Gammarus mucronatus
Grandidierella sp.
Hemiaegina minuta
Isaeidae
Listriella clymenellae
Luconacea incerta
Melita cf. *nitidea*
Microprotopus raneyi
Monoculodes sp.
Parahaustoris sp.
Photis sp.
Pontoporeiinae
Synchelidium sp.
Synopiidae
Amphipod A (*Photis*-like)

Order Decapoda

Family Penaeidae

Penaeus aztecus
Penaeus setiferus

Family Alpheidae

Alpheus heterochaelis
Alpheus sp.

Family Palaemonidae

Palaemonetes vulgaris

Family Ogyrididae

Ogyrides limicola

Family Callianassidae

Callianassa atlantica

Family Porcellanidae

Euceramus praelongus
Petrolisthes armatus

Family Paguridae

Clibanarius vittatus
Pagurus annulipes
Pagurus longicarpus
Paguristes spinipes

Family Leucosiidae

Persephona punctata aquilonaris

Family Callapidae

Hepatella sp.
Hepatus pudibundus

Family Portunidae

Callinectes danae
Callinectes ornatus
Callinectes sapidus

Family Xanthidae

Eurypanopeus depressus
Menippe mercenaria
Micropanope nuttingi
Neopanope texana
Panopeus herbstii
Rithropanopeus harrisii

Family Pinnotheridae

Pinnixa cristata
Pinnixa cylindrica
Pinnixa retinens
Pinnixa sayana

Family Parthenopidae

Heterocrypta granulata

PHYLUM SIPUNCULIDA

Phascolion strombi

PHYLUM PHORONIDA

Phoronis architecta

PHYLUM ECHINODERMATA
Class Ophiuroidea
Hemipholis elongata
Micropholis atra
Class Holothuroidea
Pentamera pulcherrima

PHYLUM CHORDATA
SUBPHYLUM UROCHORDATA
Class Ascidiacea
Bostrichobranchus pilulargis
Molgula manhattensis
SUBPHYLUM CEPHALOCHORDATA
Branchiostoma caribaeum
SUBPHYLUM VERTEBRATA
Class Osteichthyes
Blenny larva
Gobiosoma bosci
Gobiosoma longipala
Gobiosoma robustum
Gobiosoma shufeldti
Ophidion sp.
Opsanus beta
Symphurus plaguosia
Microgobius thallasinus

+ - believed to be accidental in benthos

Table 18. Benthos standing crop values*

Line Site	July '73	Aug. '73	Sept.'73	Oct. '73	Nov. '73
Nueces Bay					
38-2	593	342	143	40	151
53-2	335	425	418	209	74
53-4	130	82	115	54	49
64-10	3903	458	612	58	12
$\bar{x}$	1240	327	322	90	72
Corpus Christi Bay					
122-1	304	259	110	109	97
122-6	182	1380	396	200	246
122-12	44	28	62	40	133
127-2	89	2007	645	356	435
127-3	90	241	853	265	131
127-6	78	188	177	110	31
131-2	20	137	16	245	118
142-2	153	135	59	53	96
142-6	121	64	139	79	53
142-10	14	16	85	36	68
147-1	362	276	217	192	197
147-3	1123	891	1256	377	194
147-5	59	73	107	125	91
151-2	151	24	242	76	119
152-2	778	739	721	90	74
200-2	201	251	328	8	1052
$\bar{x}$	236	415	338	148	196
Copano Bay					
44-2	219	14	1	6	3
54-1	8	6	2	11	0
54-3	284	311	24	81	38
77-2	96	147	210	5	15
$\bar{x}$	152	120	59	26	14
Aransas Bay					
100-2	228	133	152	100	65
104-2	204	76	116	140	80
104-6	157	272	75	143	197
115-5	125	115	59	88	47
120-3	73	5	14	20	11
141-1	517	206	211	190	236
$\bar{x}$	217	135	104	114	106

* Counts are individuals per ½ cubic foot

Table 18. cont.'d

Line Site	Dec. '73	Jan. '74	Feb. '74	Mar. '74	Apr. '74
Nueces Bay					
38-2	108	51	279	888	716
53-2	106	120	257	342	408
53-4	46	58	71	109	11
64-10	7	783	127	274	1244
$\bar{x}$	67	253	183	403	595
Corpus Christi Bay					
122-1	77	145	85	93	142
122-6	157	605	513	178	713
122-12	16	29	22	8	109
127-2	1012	866	462	857	607
127-3	143	151	175	130	354
127-6	113	130	106	66	84
131-2	85	113	92	121	615
142-2	62	34	78	87	105
142-6	40	178	55	53	110
142-10	13	28	100	117	23
147-1	156	676	202	575	329
147-3	811	2280	1479	1358	309
147-5	50	60	188	179	40
151-2	86	47	132	188	42
152-2	452	1891	1433	416	3627
200-2	417	1514	61	509	382
$\bar{x}$	228	547	324	308	474
Copano Bay					
44-2	10	3	2	6	17
54-1	3	0	2	11	2
54-3	136	83	437	82	131
77-2	18	48	336	1403	17
$\bar{x}$	42	34	194	376	42
Aransas Bay					
100-2	98	104	85	115	166
104-2	53	149	159	243	512
104-6	282	476	227	6	198
115-5	65	50	60	120	207
120-3	4	2	46	34	35
141-1	927	315	228	205	206
$\bar{x}$	238	183	134	120	221

*Counts are individuals per ½ cubic foot followed by Nueces Bay while Copano Bay has the lowest. This basic pattern was observed in the first report. Maximum standing crop value was 3903 ind./$\frac{1}{2}$ ft^3 found at station 64-10 in July. No benthic organisms were found in the samples from station 54-1 in November, 1973 and January, 1974. Samples from several stations from the first report period had no organisms but the maximum from that period was much higher, 11,896 ind/$\frac{1}{2}$ ft^3 at 122-12 in December, 1972.

A comparison of data from the two report periods indicates that standing crop has generally decreased during the second period. This is particularly true when one compares the values from October - January of each period in Corpus Christi and Nueces Bay. The general decrease for similar months during the second study period is not as apparent for Copano and Aransas Bays. Their standing crop values are similar during both report periods. There was a tendency during the latter months (January - June) of the first period toward decreasing mean values in Corpus Christi Bay.

A major disparity exists between the December, 1972 and December, 1973 values. There was a decided increase in mean standing crop values in all bays except Aransas Bay during the month of December, 1972. December, 1973 saw a decided decrease in Nueces Bay mean standing crop values and a possible increase only in Aransas Bay.

When comparing standing crops at individual stations through time there is usually a fair amount of consistency. Station 54-1 in Copano Bay is a prime example of a consistently depauperate station. Stations 64-10, 147-3 and 152-2 regularly have high standing crop values, although some variation is noted. The standing crop values from station 64-10 were consistently high throughout the first report period and until October of the second study period, at which time standing crop decreased drastically. Some decrease is noted at other stations in Nueces Bay, but nothing on the order of the decrease noted at station 64-10. Generally, any extreme decrease from the "normal" standing crop at a given station is associated with a physical or hydrological factor which might explain it. Deviations to the high side of "normal" are usually associated with an increase in numbers of one or two species.

Species diversity ($\bar{d}$) values for benthic samples from both report periods are given in Table 19. Diversity values were not calculated during the first report period, so are now reported. Values ranged from 4.7090 at 147-1 in March, 1973 to 0.0710 at 142-10 in March, 1974.

Comparison of $\bar{d}$ values from all bays by month shows little difference between bays for the first two months of the present report period (July and August, 1973). Values from most stations during these months are fairly uniform with several exceptions. Station 200-2 had very low values for both months. It also had redundancy values of 0.94 and 0.89 for these months. Several stations which have been consistantly "good" benthic stations, eg. 152-2, 122-6, 122-12, 127-2 and 147-3, maintain their high values. In the following months, $\bar{d}$ values declined rapidly in some bays. The upper stations in Nueces (38-2, 53-2 and 53-4) and Copano (44-2, 54-1 and 54-3) Bays decline in September. Both bays show a slight improvement in March, 1974, but while the Nueces Bay stations continue to improve, the Copano Bay stations again decline in April. The Aransas Bay stations also show a decline, although less drastic, during the fall and winter months. It appears that there is little fall and winter effect on the benthic populations in Corpus Christi Bay

Table 19. Species diversity ($\overline{d}$) values for benthos samples

Line Site	Oct. '72	Nov. '72	Dec. '72	Jan. '73	Feb. '73
Nueces Bay					
25-2	**	0.9184	2.0370	1.3743	N.S.
38-2	N.S.	N.S.	N.S.	N.S.	2.0314
53-2	0.5304	1.4557	1.2395	2.3558	0.5033
53-4	*	2.3510	0.4032	0.0730	0.6971
64-10	2.2021	3.7390	3.9837	4.0660	4.4341
Corpus Christi Bay					
122-1	1.6499	2.7840	2.2958	2.2293	2.4308
122-6	3.1033	3.6504	3.8041	3.6653	3.3448
122-12	2.3110	1.7081	2.9975	1.2489	2.2160
127-2	2.9586	2.3201	2.5516	2.9734	2.5195
127-3	1.8687	1.9649	2.3623	2.5581	2.7635
127-6	1.6268	1.9475	2.3133	2.6938	2.8353
131-2	2.6993	3.1774	3.4503	0.6654	3.0869
142-2	1.7827	1.2711	1.9411	0.6550	2.1596
142-6	1.8691	1.3954	1.9567	2.8732	2.9177
142-10	2.7191	1.2385	2.5726	2.4999	2.8649
147-1	4.0614	4.0657	4.2791	1.9128	3.8925
147-3	3.0297	2.6836	4.0127	2.1590	2.1000
147-5	2.2880	3.0182	1.9901	2.5561	3.3295
151-2	1.5001	3.1801	3.2040	*	1.6309
152-2	4.4471	4.1770	3.7710	4.6685	4.1809
200-2	2.2518	3.2440	0.7138	1.5336	1.7372
Copano Bay					
44-2	*	**	2.1867	2.8229	1.9864
54-1	*	1.3711	2.5774	0.8114	1.5001
54-3	2.3216	1.5851	2.0338	0.9184	0.8811
77-2	1.6495	0.8114	1.5221	1.8551	2.4924
Aransas Bay					
100-2	2.1558	1.3329	2.6402	2.2314	2.2435
104-2	1.7808	3.0208	3.4575	2.7286	2.8049
104-6	2.9937	3.3062	2.9937	2.0788	2.5153
115-5	1.3789	1.9484	2.5861	2.6706	2.4212
120-3	0.9999	1.8912	2.4809	1.5001	2.3701
141-1	0.3057	1.5765	2.9293	1.9343	3.1339

* - Only 1 species present, no value calculated
** - No organism present, no value calculated
N.S.- No sample taken

Table 19. cont.'d

Line Site	Mar. '73	Apr. '73	May '73	June '73	July '73
Nueces Bay					
25-2	N.S.	N.S.	N.S.	N.S.	N.S.
38-2	1.3961	0.9208	2.6408	2.5388	2.4217
53-2	1.5801	1.7296	2.1416	1.6896	1.2237
53-4	1.1403	2.5440	2.3862	2.2693	1.5734
64-10	3.2660	2.9740	3.7817	3.9156	1.6925
Corpus Christi Bay					
122-1	2.8406	2.7038	2.1504	2.1334	2.1962
122-6	3.4187	3.8652	4.1856	4.0886	4.0421
122-12	2.5258	2.9977	3.1876	2.5994	1.7537
127-2	2.5022	2.9632	2.6877	2.4409	3.4376
127-3	1.7383	2.8094	2.8426	2.4791	2.6528
127-6	2.3289	2.8189	2.2287	2.4244	1.9317
131-2	0.2864	2.7975	2.0564	0.8114	1.0541
142-2	2.2361	3.0433	2.8067	1.9225	3.1082
142-6	2.7367	2.9378	2.0819	2.6045	2.1238
142-10	1.9134	1.8112	2.4997	2.0590	2.4140
147-1	4.7090	4.0374	3.4163	3.4340	3.4773
147-3	1.0607	3.3264	3.4001	3.7541	3.8118
147-5	4.2826	3.9263	2.2533	2.4901	3.2201
151-2	1.7218	1.4777	3.2626	2.9798	3.2634
152-2	4.4297	4.5425	4.2975	4.2577	4.6221
200-2	1.6753	2.5744	2.4039	1.4539	0.4208
Copano Bay					
44-2	1.6139	2.6115	2.1716	1.8466	2.5975
54-1	2.2463	1.2417	*	**	2.0002
54-3	2.1180	1.4990	2.5139	1.9469	1.2619
77-2	3.1413	3.0568	1.4593	2.3237	1.0401
Aransas Bay					
100-2	2.5043	1.5323	2.1613	2.1480	1.3523
104-2	3.8766	3.3634	3.1939	3.2823	3.0868
104-6	3.2337	2.4109	3.1088	2.6194	2.1659
115-5	2.9890	2.6402	2.3637	2.5459	2.0913
120-3	3.0809	2.4827	2.2518	2.1361	2.0798
141-1	2.2216	3.6509	3.2102	3.2570	1.4692

* - Only 1 species present, no value calculated
** - No organisms present, no value calculated
N.S.- No sample taken

Table 19. cont.'d

Line Site	Aug. '73	Sept.'73	Oct. '73	Nov. '73	Dec. '73
Nueces Bay					
25-2	N.S.	N.S.	N.S.	N.S.	N.S.
38-2	1.4544	0.8555	0.7150	0.5511	0.9251
53-2	1.1118	1.4122	0.9485	0.8635	0.9960
53-4	1.2770	1.5326	1.4952	0.4755	1.3219
64-10	3.4430	3.1422	1.8841	1.9510	1.1489
Corpus Christi Bay					
122-1	2.5114	2.0786	1.7361	1.4349	1.7084
122-6	3.3641	3.9070	2.7611	3.0550	3.8266
122-12	2.8933	2.2794	0.9604	2.0624	1.4968
127-2	3.1874	2.9048	3.4660	3.3069	3.0187
127-3	2.7495	2.3032	3.4403	2.6716	3.0614
127-6	2.4192	2.8855	2.1439	*	1.8498
131-2	1.5562	1.1980	1.5911	1.1424	1.8689
142-2	3.1718	3.2516	3.7626	2.3958	2.9194
142-6	3.0112	3.2054	2.1735	2.0118	2.7023
142-10	2.4997	0.2762	0.1831	0.5594	0.6194
147-1	3.2130	2.3693	3.3460	2.9555	2.8866
147-3	3.9326	3.9894	2.0112	3.4906	2.3154
147-5	3.5177	2.6310	2.6163	2.5688	1.9671
151-2	3.1527	3.1343	2.1883	1.5129	1.6358
152-2	4.0307	3.3489	3.5861	2.8720	3.9895
200-2	0.5886	1.1524	2.7503	1.5584	1.9210
Copano Bay					
44-2	1.4297	*	0.9184	0.9184	1.9611
54-1	2.2513	*	2.0496	**	0.9184
54-3	0.6455	1.5450	1.3784	0.8597	0.3400
77-2	2.1568	1.6239	1.5221	1.7970	2.8858
Aransas Bay					
100-2	0.4758	2.0753	1.3490	1.1179	1.3229
104-2	2.4175	2.9115	2.1432	1.8333	2.0861
104-6	1.8859	2.6545	1.7992	1.9252	1.5800
115-5	1.8451	1.9321	1.5752	1.1676	1.2085
120-3	1.9221	1.9504	2.3957	1.6731	1.5001
141-1	2.3932	3.0973	2.7706	1.4257	0.6126

* - Only 1 species present, no value calculated
** - No organisms present, no value calculated
N.S.- No sample taken

Table 19. cont.'d

Line Site	Jan. '74	Feb. '74	Mar. '74	Apr. '74
Nueces Bay				
25-2	N.S.	N.S.	N.S.	N.S.
38-2	0.8300	0.7926	2.3071	2.2420
53-2	1.1483	1.6674	2.0621	2.4363
53-4	0.3757	1.2344	1.9507	3.4590
64-10	1.7049	2.7317	3.6127	2.5029
Corpus Christi Bay				
122-1	2.5457	1.9116	2.0930	2.0436
122-6	3.4840	2.9155	3.2891	3.1272
122-12	2.5266	2.2760	1.5489	1.5919
127-2	3.4502	3.3516	4.3800	3.8971
127-3	3.0832	2.9292	3.3149	3.1526
127-6	2.0247	2.1685	2.7225	2.4634
131-2	0.9990	1.3280	2.3800	0.9566
142-2	2.8058	2.9786	3.4470	3.3189
142-6	2.8792	2.4810	2.9561	2.3955
142-10	1.2343	0.1615	0.0710	1.3536
147-1	2.5819	3.1636	2.5527	3.2952
147-3	3.1683	3.6141	3.9611	3.3373
147-5	1.2390	4.2740	3.4964	3.7806
151-2	2.7847	3.6510	2.4848	1.0966
152-2	3.9041	3.7001	4.4966	4.3607
200-2	2.4695	2.8141	1.6069	2.2586
Copano Bay				
44-2	1.5847	*	1.7926	0.8344
54-1	**	*	2.4042	0.9999
54-3	1.2106	0.6046	1.7327	1.9736
77-2	1.5071	2.6828	1.7259	1.9691
Aransas Bay				
100-2	1.6504	1.7933	2.0704	1.4862
104-2	2.2602	2.2204	1.8399	1.9924
104-6	1.7349	1.5764	1.2517	1.9826
115-5	1.2412	1.8433	1.9391	1.5451
120-3	0.9999	1.2328	1.6061	1.2683
141-1	2.0906	2.5516	2.4756	1.5838

* - Only one species present, no value calculated
** - No organisms present, no value calculated
N.S.- No sample taken

although certain stations, eg. 142-10, showed a rapid and sustained decrease in $\overline{d}$ values. Several stations showed a decrease in $\overline{d}$ for one month, eg. 122-12 in October, 1973. These normally occurred with fairly small total numbers and strong dominance of one species (eg. Prionospio pinnata at 122-12). March and April, 1974 saw a general rise in $\overline{d}$ values to approximate those of the previous summer, although upper Copano Bay stations remained low.

No similar pattern of a generalized diminishment of $\overline{d}$ values is seen in any bays during October through February from the first report period.

The consistency through time mentioned in respect to standing crop values is also seen in most of the species diversity data. Several stations show variations which lead to interesting discussion. Station 64-10 had maintained a very high $\overline{d}$ value until October, 1973, except for July when a tremendous dominance of Streblospio benedicti occurred. After October, the diversity decreased far out of proportion to the decrease in $\overline{d}$ values of the stations around it. In February, 1974, diversity values again increased. Station 142-10 maintained a good $\overline{d}$ value until September, 1973 and then decreased rapidly. Again, others showed sharp decreases for short periods of time.

Some analysis has been attempted on the distribution of individual benthic species, particularly the polychaetes of Copano-Aransas Bays which have been given intensive scrutiny in preparation for an upcoming publication. Several noteworthy observations have been made. Mulinia lateralis, a fairly wide-spread estuarine bivalve, seems to have a very cyclic occurrence. In the early months of our study, we found this organism to be very dominant at several stations. It rapidly lost dominance and was found in moderate numbers at two or three stations. Our most ubiquitous organism is undoubtedly Mediomastus californiensis, a tiny polychaetous annelid. It is found at all times during the year and is usually a community dominant where found. Along with M. californiensis, Streblospio benedicti, Prionospio pinnata, Nereis succinea and Glycinde solitaria are among the most common benthic organisms we encounter.

We have made progress with the use of multivariate analysis techniques designed to handle large quantities of data such as are generated in this study. The specific technique with which we have been working is cluster analysis. A data matrix of polychaete occurrences from the Copano - Aransas Bay area has been completed and initial computer runs have been made. This technique is designed to group organisms that are similar in their temporal and spatial distribution and to group sampling sites that are similar in their benthic populations. Since analysis of this data is not complete, a final discussion of the data will be delayed until the next report.

Discussion.

The benthic taxonomical listing of three hundred and thirty eight taxa for our study area (Table 17) is a slightly enlarged revision of that in the initial report. Some groups, eg. amphipods, have been reworked and identified more satisfactorily. "New" species are being found less frequently. One species of polychaete, Scoloplos sp. nov., is believed to be new to science and will be described in a forthcoming publication.

The general decrease in standing crop for the months of October - February of the second report period may have several explanations. During the early months of this study, we collected near oil well platforms at several stations (eg. 122-12, 147-3). We realized after the first three months of collecting that we were sampling artificial shell pads deposited at the oil well drilling sites prior to drilling. We felt that this data was not as useful to this study as that from "natural" bay bottoms and moved our sampling sites slightly to get off the artificial shell pads. The data from the shell pads showed a much higher standing crop than was found at the natural bay bottom sites. This fact could have elevated the standing crop values for the first few months of the project and thereby make the second series of standing crop data seem low. This explanation is valid only for Corpus Christi Bay. The general decrease in mean standing crop in Nueces Bay for the fall-winter months of the second report period may be explained by two factors. The first is salinity. As has been previously noted, very low salinity regimes were found in Nueces, Copano and Aransas Bays during the months of October, November and December, 1973. The extremely low salinities could have adversely affected the more marine benthic populations that had become established due to the relatively high salinities in Nueces Bay during the preceeding year. The second reason for the low values in Nueces Bay is that an oyster shell dredge was moved into Nueces Bay in September, 1973 and located about three hundred yards from our 64-10 site. We immediately began to notice spoil mud deposited at the sampling site and a decrease in standing crop and species diversity figures. The dredge remained about three months and the benthos population began to recover in January, 1974. This site has a major influence on the monthly means of Nueces Bay, and when its benthic population diminished, the monthly mean for the bay was considerably affected.

Increases in standing crop occur primarily due to a large increase of a single species although periodically several species seem to increase simultaneously. These "blooms" are sporadic and may be due to patchiness of distribution of some species or to a real population increase through seasonal reproduction.

Species diversity analysis of benthic populations as a method of observing community structure with reference to possible environmental stress is a widely used technique (Holland et al., 1973b; Wilhm and Dorris, 1968; Coull, 1972 and Gage, 1972). It is assumed that higher diversity values are associated with more stable benthic community structures, and in turn, these more stable communities reflect an environment of higher quality to the organisms living within it. As has been pointed out, this hypothesis may not hold true for the phytoplankton and zooplankton populations within our study area, but may be valid for the benthic communities of our area. Diversity values like $\bar{d}$, which is an individual diversity index, are relatively independent of sample size. As all diversity indices it diminishes with an increase of dominance within samples. That is, if one or two species are dominant within a given sample, the $\bar{d}$ figure is low. This is the salient feature of species diversity indices: the whole idea is to be able to point out environments in which only a few species are able to survive, as is often the case in polluted or otherwise highly stressed environments. However, we are realizing that due to the fecundity of certain benthic organisms at specific times (cyclic reproduction) or to extreme patchiness, we should examine many samples through time to get an accurate picture of the environment. A single diversity figure at any given site may certainly give an erroneous picture of the environment at that site.

It is interesting to note that the effect upon benthic community structure of the dredging operation in Nueces Bay was indicated by the diversity data from 64-10. The diversity data from 142-10 which showed a sudden decrease in September, 1973 and remained low throughout the second study period is also of particular interest. This site has never been an extremely "good" benthos site but appeared to be a healthy estuarine environment with $\bar{d}$ figures around 2.0. Upon examination of the data from 142-10 from September and subsequent months, one sees a pattern of dominance of a single polychaete, Streblospio benedicti. There is no known reason for this sudden dominance by this species. A slight change in collecting site may have occurred.

In general, benthos populations in our study area tend to compare quite favorably in both standing crop and diversity to those studied in other Texas bays. (Holland et al., 1973b; Matthews and Marcin, 1973; Matthews et al., 1974 and Moseley, 1971).

Analysis of sediment data should prove of value in understanding benthic population distribution. Sediment data (Table 20) for November, 1973 and February, 1974 tend to indicate a sizeable variation at various stations. Several stations (122-1, 147-5, 115-5, 142-6 and 142-10) appear to remain fairly stable in terms of relative percentages of various sediment components. Other stations exhibit wide variation in sediment composition. Most often the variations involve changes in the percentages of silt and clay with the sand fractions remaining relatively similar. We are hoping that with further sediment analyses, patterns involving sediment composition and benthic population composition can be seen.

Table 20. Sediment analysis

Line Site	November 1973 % Silt	November 1973 % Clay	November 1973 % Sand	February 1974 % Silt	February 1974 % Clay	February 1974 % Sand
Nueces Bay						
38-2	10.8	84.4	4.8	36.1	59.9	4.0
53-2	11.4	47.0	41.5	18.6	43.1	38.3
53-4	19.4	65.1	15.2	56.5	5.4	38.1
64-10	15.0	76.4	8.4	66.9	25.5	7.6
Corpus Christi Bay						
122-1	27.9	66.7	4.9	28.6	67.7	3.7
122-6	66.2	31.2	2.4	83.5	9.5	7.0
122-12	14.7	76.5	8.7	14.5	75.9	9.6
127-2	26.0	68.2	5.7	23.7	63.1	13.2
127-3	41.2	41.6	17.0	25.9	45.2	28.9
127-6	14.3	81.7	3.8	15.3	81.5	3.2
131-2	28.5	71.5	0.0	59.1	38.6	2.3
142-2	29.4	70.6	0.0	55.7	44.0	0.3
142-6	34.2	64.1	1.7	26.6	68.6	4.8
142-10	33.6	64.1	2.3	22.7	75.6	1.7
147-1	19.9	23.4	56.7	9.8	20.1	70.1
147-3	18.5	58.3	23.2	49.0	45.1	5.9
147-5	0.0	0.0	100.0	0.0	0.0	100.0
151-2	32.7	19.5	47.8	37.7	9.6	52.7
152-2	26.3	22.8	50.9	7.4	7.5	85.1
200-2	18.3	40.5	41.2	9.9	6.1	84.0
Copano Bay						
44-2	17.4	72.8	9.7	16.0	75.6	8.4
54-1	18.0	80.9	1.1	4.1	92.6	3.3
54-3	2.0	53.1	44.9	6.1	4.7	89.2
77-2	3.5	96.5	0.0	15.1	66.6	18.3
Aransas Bay						
100-2	7.6	46.4	46.0	21.7	34.3	44.0
104-2	32.5	46.5	21.0	20.5	61.5	18.0
104-6	5.4	18.6	75.9	4.3	19.0	76.7
115-5	27.3	57.8	14.9	29.6	60.8	9.6
120-3	19.1	76.5	4.3	37.4	57.3	5.3
141-1	8.7	28.0	63.3	55.2	39.6	5.2

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